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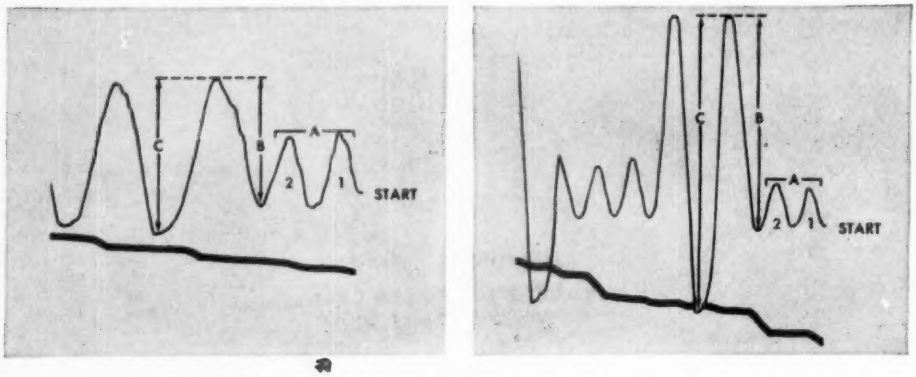

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Schwartz, E., *J.A.M.A.* 147: 1734–1737. Dec. 29, 1951.

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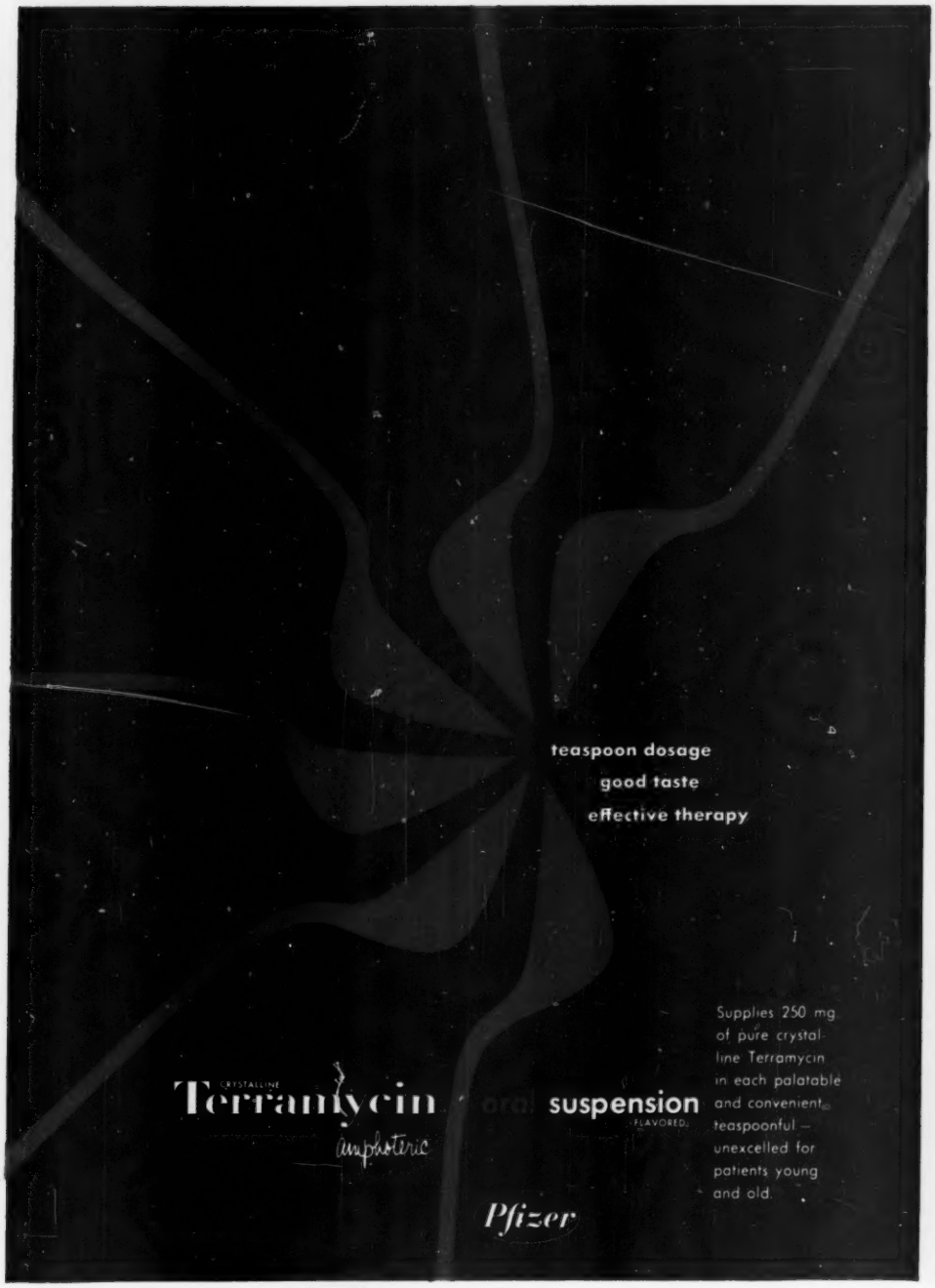

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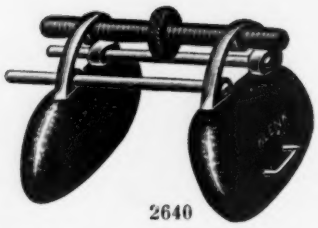

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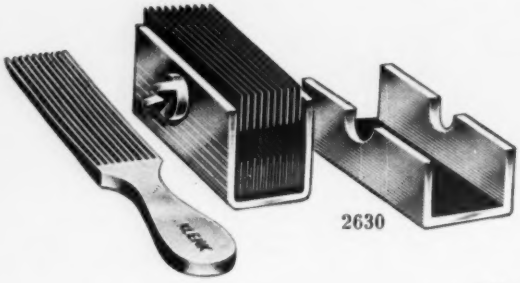

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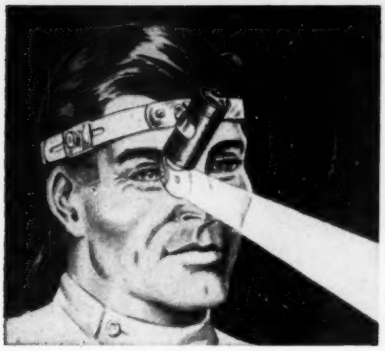

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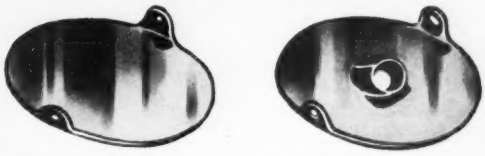

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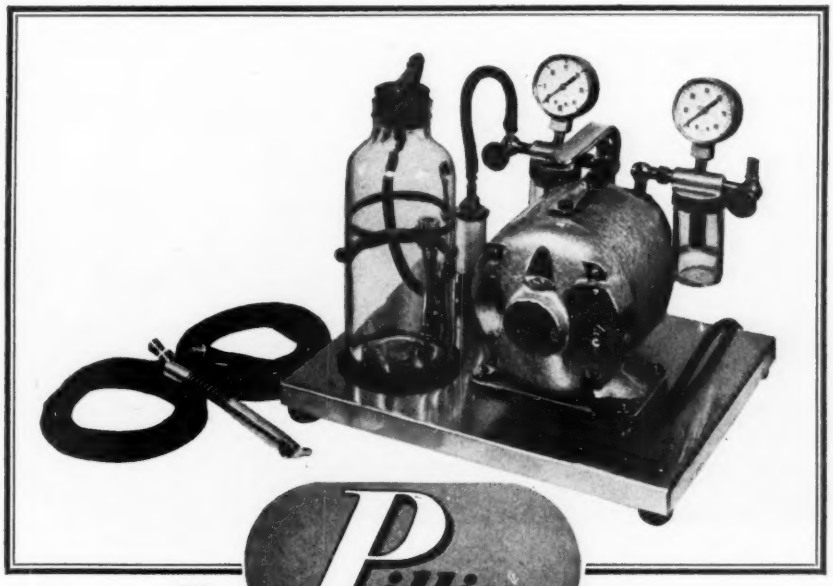

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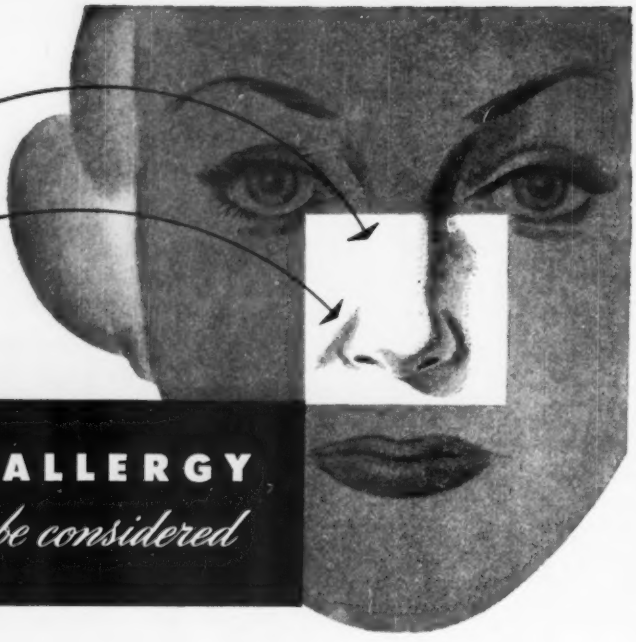

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ARCHIVES OF OTOLARYNGOLOGY

VOLUME 56 DECEMBER 1952 NUMBER 6

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VESTIBULAR RESPONSES IN THE NEWBORN

WALTER E. HECK, M.D.
SAN FRANCISCO

THE STATEMENT that the labyrinth is inactive in the newborn has been made on several occasions at medical meetings. It has been heard personally and quoted by others. A casual review of the literature did not reveal any specific data.

It was therefore decided to check the validity of the statement. A Bárány rotating chair was taken to the nursery for the newborn of Stanford University Hospital, and one of the nurses was seated in it, holding a newborn baby in her lap. The baby's head was held so that Reed's base line (from the external canthus of the eye to the external auditory meatus) was horizontal, i. e., the horizontal canals were in the plane of rotation.[1]

The conventional rotation of 10 turns in 20 seconds produced an active horizontal postrotational nystagmus, of medium to coarse character, in each baby tested. Each baby was rotated first in one direction, then after an interval in the other direction. The nystagmus (quick component) was in each instance in a direction opposite to that of the rotation. Obviously it was difficult to observe the duration of the nystagmus and impossible to determine whether it was of first, second, or third degree. Roughly the duration was one-half minute.

There was no question, however, of typical active labyrinthine response to the rotational stimulus.

Three babies were tested, one 2 hours old, another 3 days old, and the third 5 days old. All exhibited active responses.

SUMMARY AND CONCLUSION

The labyrinths of three newborn babies were stimulated by means of rotation. Each showed active conventional postrotational nystagmus responses. The labyrinthine apparatus is therefore presumed to be actively functioning in the newborn.

The nurses in the nursery for the newborn at Stanford University Hospital assisted in the testing.

From the Division of Otorhinolaryngology, Department of Surgery, Stanford University School of Medicine.

1. Heck, W. E.: Vestibular Testing, Stanford M. Bull. **9**:156-159 (Aug.) 1951.

PROCEDURE FOR RHINOPLASTIES

Reduction in Size and Repositioning of Nose

LYNDON A. PEER, M.D.
AND
JOHN C. WALKER Jr., M.D.
NEWARK, N. J.

POSTOPERATIVE results following a rhinoplasty procedure have improved greatly during the past 20 years. Consequently, operations which in the past were often hazardous and associated with variable results are now successfully managed by somewhat standardized procedures. These standardized procedures vary with different surgeons, but all satisfactory techniques are similar in principle and not difficult to understand.

The modern rhinoplasty techniques are all based on the fortunate facts that the supporting framework of the nose can be altered through incisions made inside the nasal cavities, where scars are not visible, and that the covering nasal skin will contract or stretch to conform with the changed shape of the nasal framework. This inherent quality of the skin to stretch or contract is due to elastic fibers in the dermis, but there are limits to the elasticity which may not safely be ignored. Thus, the insertion of too bulky a rib graft may cause the skin to stretch to the point of pressure necrosis, and, alternately, a large reduction in the height of the nose may result in unsightly folds of skin at the sides or at the nasal tip.

Overcorrection of a nasal deformity should always be avoided. The normal ego of most persons will rebel against too radical a change in appearance, and a nose which looks as though it had been operated on is seldom acceptable to the patient. In general, it is wise to alter the nose until it appears in harmonious relationship with the total facial structure. When the nose looks right, it usually is right for the facial character in the particular case, and further alteration is likely to produce overcorrection.

Another important conception in rhinoplasty is the development of a somewhat standardized basic technique which can be modified at will to meet the problems in individual cases. Although the operative technique may be standardized advantageously, it is never wise to standardize the postoperative appearance of the nose. This should be varied for different patients, with emphasis on undercorrection rather than overcorrection.

It is advantageous for the patients, both economically and psychically, if the submucous resection and the rhinoplasty are combined in one operation. An inferior turbinectomy and occasionally a middle turbinectomy may be required to provide adequate breathing space or room for sinus drainage, and the operator should be equipped to do the intranasal and the extranasal surgery as the occasion arises.

OPERATIVE PROCEDURE

The technique is one that has been standardized by one of us, the senior (L. A. P.), and is used in our practice and residency training. It is carried out with ease in execution and with confidence in postoperative results, and it is adaptable for the correction of most types of oversized nasal deformity.

This technique is based on the principles formulated by Joseph of Berlin, modified by variations to meet the mechanical problems presented in individual cases. All operations are performed with the patient under general anesthesia, preferably thiopental (pentothal®) sodium, unless otherwise indicated or requested. We use general anesthesia in preference to local anesthesia, realizing that the bleeding will be more profuse, but the use of general anesthesia permits complete relaxation on the part of the patient and frees the surgeon from much tension and strain.

After the patient is anesthetized, we make a careful analysis of the external and the internal structure of the nose and determine all main objectives of our operative procedure. The soft tissues of the entire nasal structure are injected with saline to which eight drops of epinephrine to the ounce have been added. This injection facilitates dissection and helps to control the bleeding. Additional bleeding which occurs after undermining of the tissues may be lessened by packing with sponges soaked in epinephrine.

Technique.—1. An incision is made between the lower border of the lateral cartilage and the upper border of the alar cartilage and is carried downward along the top of the septum and, when necessary, in front of the septum, separating the columella from the lower end of the septal cartilage. A periosteal separator is inserted in the incision and the periosteum elevated from the bony nasal arch. This procedure is repeated on the other side, so that the overlying nasal skin is detached from the underlying bony and cartilaginous support.

2. The lateral cartilages are detached from the septum with straight scissors and retracted laterally.

3. The cartilaginous bridge of the nose is lowered by making an incision with a Bard-Parker scalpel through the septal cartilage and septal mucous membrane, beginning at the tip and extending upward to the bony bridge. The thickness of this cartilage which is to be removed from the upper portion of the septum depends upon how much one desires to lower the nose. In some cases this will be very little and in other cases perhaps a considerable amount.

4. A wide osteotome is then inserted through the cartilaginous incision, so that the cutting edge rests against the bony bridge of the nose, and the bony hump is removed by tapping the osteotome gently but persistently. The osteotome may be directed slightly downward in the glabellar region to obtain a concavity at this point. The cartilage and bone are then removed with a hemostat.

5. Superior portions of the lateral cartilages which project above the new level of the nose are trimmed with straight scissors, so that they conform to the altered nasal line. If irregularities are present where the bony hump has been removed, these are smoothed off by means of a sharp nasal rasp and the bone chips removed with a curette.

6. When the line of the nose is inspected after removal of the hump, one usually notes that the tip has a somewhat rounded and broad appearance. Removal of the

upper posterior part of the alar cartilages on each side, without sacrifice of any of the lining membrane, will reduce this prominence. If the tip is wide but does not have a definite cleft with separation of the domes of the alar cartilages, narrowing may be accomplished by removal of a V-segment from the remaining rim of alar cartilage near the free border of the nostril. When the tip is broad and also has a cleft, a modified Joseph technique is used, as shown in Figure 4.

Fig. 1.—(*a*) The picture represents a rather typical hump nose in which it is necessary to remove the upper part of the septal cartilage, as well as the bony hump, in order to obtain a satisfactory line for the nasal dorsum. (*b*) The soft tissues of the nose have been completely separated from the underlying bone and cartilage structure, and the lateral cartilages have been separated from their attachment to the septum; an incision has been made through the lower portion of the septal cartilage from the tip to the nasal bone; the osteotome inserted at the apex of this incision is gently tapped, removing the bony hump and the attached portion of septal cartilage. (*c*) Lowered line of nose following removal of upper portion of septal cartilage and the attached bony hump; small irregularities on the bony bridge are smoothed out with a rasp and the chips removed with a curette.

7. If the septum is displaced anteriorly, the procedure shown in Figure 5 is used, and additional cartilage and septal bone are removed if they are obstructive to breathing or sinus drainage. When the posterior portion of the septum alone is obstructive or has a sharp deviation high up, which might prevent infracture of one side of the bony bridge, a conventional submucous resection operation is performed. Inferior turbinates that are obstructive are reduced to conform with the new position

Fig. 2.—(*a*) An osteotome inserted through a small incision inside the nose near the periform ridge is gently tapped with a mallet, separating the bony arch of the nose from its attachment to the maxilla; this separation of the bone should be rather low, so that the maxilla is not left with an unsightly ridge. (*b*) Pressure on the outside of the partially separated bone produces a greenstick fracture above and displaces the whole bony segment inward. (*c*) A lateral view of the nose following infracture on each side; the nose has been narrowed, and any flattening that occurs following removal of the hump disappears as the bony sides of the nose are brought into closer relation with the septum; occasionally it may be necessary to remove obstructive bone at the root of the nose to permit the two bony sides to come into proper approximation; it is usually helpful to separate the nasal bones from the septum with an osteotome before infracture.

of the septum, so that the breathing space is adequate. Occasionally it may be necessary to remove the anterior portion of a middle turbinate to provide better sinus drainage.

8. The bony bridge of the nose is fractured with a chisel inserted through an incision inside the nose, care being exercised to make the line of fracture low down at the base of the nasal arch so as to avoid an unsightly bony ridge, or prominence, at the point of fracture. The nasal bone is separated from the septum on each side by the use of a fine osteotome, by lateral movement of which the bony arch is outfractured. Manipulation of the sides of the bony arch from the outside of the nose will rearrange the fractured bony segments in proper position and effect a narrowing of the bony arch. Any thick bone between the nasal bones and the bony septum which prevents repositioning of the sides can be removed with a small osteotome.

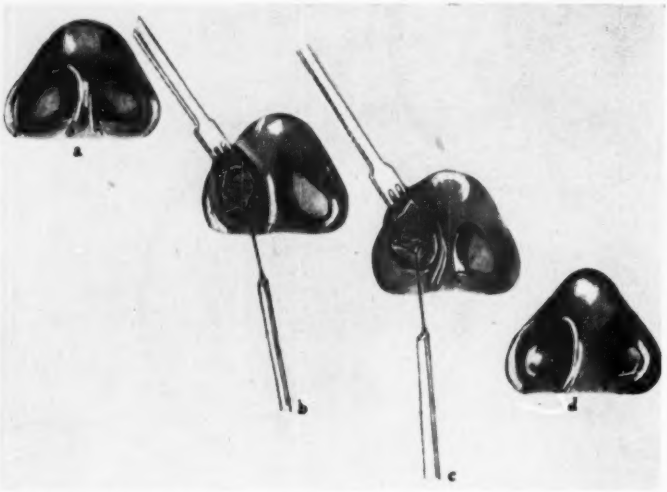

Fig. 3.—(*a*) Broad nasal tip not associated with a cleft or separation of the domes of the alar cartilages. (*b*) An incision has been made in the mucous membrane through the skin and alar cartilage, leaving a rim of cartilage for support of the nostril; the upper posterior portion of the alar cartilage has been removed without sacrificing the soft tissue lining; the triangle indicated by dotted lines shows the area of lining and alar cartilages which will be removed to effect a narrowing of the tip; this triangular excision should be lateral to the dome when the operator desires only to narrow the nose; it should be at, or slightly medial to, the dome when the operator desires to lower and narrow the nasal tip. (*c*) Triangle of lining and alar cartilage has been removed. (*d*) Drawing shows narrowing of tip following V-excision on each side.

9. If the nose is too long, shortening is effected by excising a segment from the lower border of the septal cartilage. Elevation of the tip is obtained by means of an orthopedic suture, which pulls the movable columella upward against the rigid lower border of the septal cartilage. Hypertrophied median crura are excised if they produce folds at the sides and base of the columella.

10. Grease packing is then inserted lightly in each nasal cavity, and the nose is strapped with adhesive on the outside to conform to the altered shape of the nasal framework. A dental compound splint or a metal splint is applied over the nose and is secured in position by adhesive plaster.

POSTOPERATIVE CARE

The packing is removed on the second or third day after operation, and the nasal splint is removed on the fifth day, when the patient is discharged from the hospital. A Joseph splint may be used in certain cases by the patient at home to effect further narrowing of the bony bridge or to correct lateral displacement. The patients are allowed to return to work two weeks after operation.

EVALUATION OF OUR POSTOPERATIVE RESULTS

After 21 years' experience with rhinoplasties it appears to one of us (L. A. P.) that there are a number of conditions which cannot be completely corrected in a fairly large percentage of cases. We are still faced with the fact that individual patients heal differently, and a nose which has a satisfactory line at the time of operation may emerge with an unsatisfactory line when the postoperative swelling

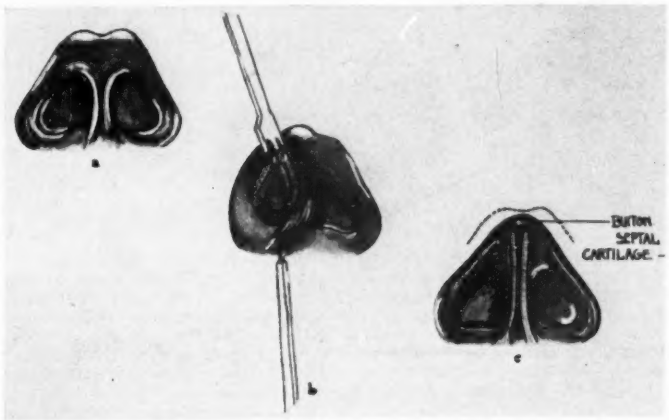

Fig. 4.—(*a*) Broad tip with a definite cleft due to separation of the domes of the alar cartilages. (*b*) Parallel incisions have been made, converting the skin and lower portion of the alar cartilage into a double pedicle flap; the upper posterior portion of the alar cartilage has been removed without sacrificing its soft tissue covering; the double pedicle flap of alar cartilage and covering skin has been severed at the apex of the alar dome, thus creating two single pedicle flaps of skin and cartilage. (*c*) The median crux of the alar cartilage with its covering skin is swung up to meet its fellow from the opposite side; it is usually expedient to fasten the two segments together with a mattress suture or with a buried No. 3-0 plain absorbable surgical suture; this procedure gives a definite point to the tip and obliterates the cleft; the lateral flaps of skin and alar cartilage are trimmed to conform with the altered shape of the tip, and a sharper tip may be obtained by inserting a septal cartilage graft between or over the domes of the median portions of the alar cartilages; the insertion of the button-cartilage graft often helps to smooth out excess folds of skin at the tip when these are present.

subsides. This condition occurs despite the fact that perhaps five other similar deformities repaired in exactly the same manner were corrected satisfactorily.

It is evident that the results following rhinoplasty resemble those following the removal of facial scars, when the individual healing qualities of different patients greatly influence the postoperative results, although the deformity in each case is repaired by the same surgeon with the same identical technique. A well-planned and well-executed operation, however, will benefit the patient to some extent, and secondary procedures may be carried out later to further improve the appearance of the nose if the degree of improvement is not acceptable.

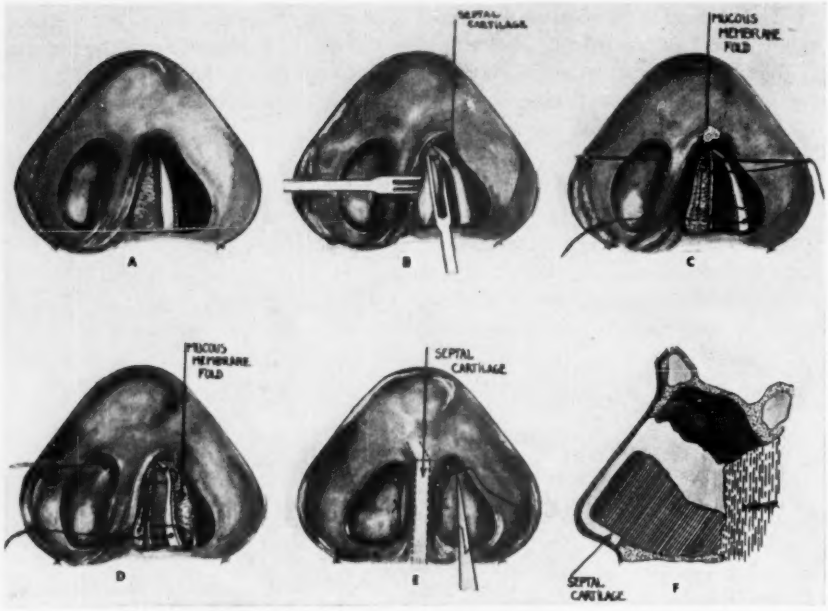

Fig. 5.—Method of repair for displacement of the lower border of the septal cartilage: *A*, diagram illustrating a deformity in which the lower free border of the septal cartilage has been displaced into the left nostril; the columella is displaced to the right, the right nostril is small, and the left nostril is correspondingly wide; often the nasal tip will be distorted away from the midline. *B*, an incision is made in the mucous membrane over the protruding free border of the septal cartilage, and the mucous membrane is elevated so as to expose completely the septal cartilage on each side, thus rendering it a free graft; this differs from the Metzenbaum technique in which the mucous membrane is left attached to one side of the cartilage; in our hands this attachment has prevented free manipulation of the cartilage when it is severely displaced; an incision is then made through the cartilage about ⅛ in. (32 mm.) behind the free border, so that a bar of cartilage is formed for the support of the nasal tip; the Ballanger swivel knife is then inserted in the upper end of this incision and carried backward, leaving a bar of cartilage along the nasal dorsum; this bar of cartilage along the dorsum is continuous with the upright bar of cartilage at the nasal tip; the Ballanger swivel knife is directed downward to the floor of the nose and forward along the floor of the nose, removing a small or a large amount of cartilage, depending on the requirements of the patient; in children only a small amount should be removed. *C*, a pocket is made between the cutaneous folds of the columella, and the base of the upright cartilage bar is separated from the floor of the nose; the diagram shows the insertion of a silk mattress suture which is designed to draw the bar of cartilage between the cutaneous folds of the columella; proper use of this suture will not only replace the cartilage in normal position but also draw the columella into correct relationship, restore width to the narrow right nostril, and draw the nasal tip over to a correct midline position. *D*, traction on the mattress suture is in the process of drawing the cartilage segment into the columellar pocket; note the mucous membrane fold on the left side, which was not shown in previous diagrams. *E*, the mattress suture which retains the septal cartilage bar in the columellar pocket is tied; this also serves to keep the folds of skin in contact with the cartilage and to prevent hematoma; the original incision in the mucous membrane is shown partially sutured. *F*, lateral diagrammatic view showing the extent of cartilage removed in the lined area; note the upright septal cartilage bar continuous with the beam of cartilage along the nasal dorsum supporting the nose; sometimes it is necessary to make a number of cuts part way through the beam of cartilage along the nasal dorsum to correct a twist of the lower nose; when the displacement is not severe, the membrane is separated on only one side.

We perform secondary "trimming operations," usually in the office, in about 6% of our cases, but we do not mean to imply that the remaining 94% are completely satisfactory in regard to line, contour, breathing space, etc. It would be more accurate to state that the patients not requiring secondary revision are those who show a sufficient degree of improvement to be satisfied.

Regardless of the surgeon's training and experience, certain variables will appear from time to time as operative or postoperative complications. Prominent among these are the following: (1) the brittle "eggshell" bony bridge, which crumbles into a number of segments after infracture; (2) the nose with very thin alar cartilages, in which too radical a removal of cartilage will cause a depression at the sides of the nostril or a notching at the free border of the nostril; (3) the tendency in certain patients for an excess amount of fibrous tissue to form just above the tip, giving an elevated and rounded appearance to the lower dorsum of the nose; (4) occasionally the nose which, set in an exact midline position at the time of operation, undergoes a positional change, in that after operation the bony bridge tends to become displaced to one side or the other; (5) lateral displacement of the lower nose due to distortion of the septal cartilage, which tends to reappear to some extent after operation despite overcorrection at the time of operation and adjustment of the lateral and alar cartilages to the new midline position of the septum; (6) the wide nasal tip with very thick skin covering, which remains thick in spite of the altered shape of the supporting cartilaginous framework.

Even though there are individual differences in healing, all oversized noses can be repaired with assurance of a considerable degree of improvement in the patient's appearance. The plastic surgeon should be honest in his approach to the patient's problem and state what he believes, from his experience with previous cases of a similar kind, can be achieved. If patients are willing to go ahead on this basis and are not definite psychopathic types, they will usually accept the degree of improvement and be satisfied with the postoperative results. A survey of all cases in which various types of deformities were treated by us indicates that the rhinoplasties were done in the cases in which the patients derived the most benefit from operation.

CLINICAL SUGGESTIONS OF PRACTICAL VALUE

When in doubt concerning the advisability of a rhinoplasty because of the patient's mental attitude, the surgeon should send him or her to a psychiatrist and should not operate without the latter's approval.

A man's nose should always be left with sufficient height to provide the appearance of strength and character. A woman's nose may be lowered much more to produce a softer effect with a rounded glabellar angle.

Radical excision of the lower portion of the septal cartilage to shorten a long nose should be avoided. The columella should always be at a lower level than the nostrils to avoid a "snubbed nose," which is very difficult to correct by secondary operation.

When removing the posterior parts of the alar cartilages to narrow the tip, the surgeon should not remove too much cartilage at the base, since this removal may give rise to an unsightly depression which produces a pinched-in appearance.

When it is necessary to remove a large portion of the posterior part of the alar cartilages, the operator should not also remove the lower part of the lateral cartilage, since this removal may cause elevation or notching of the nostril, owing to scar contracture.

If grease packing is used in the nose, the excess of petrolatum should be removed by drawing the packing through a dry gauze. Excess petrolatum may be forced through the incisions as the nose is packed and may give rise to a foreign-body reaction after operation.

An alar cartilage graft should be used to correct small depressions in the nose. Deeper saddle depressions may be filled with septal cartilage or septal bone capped by alar cartilage, providing a smooth surface contour.

Careful consideration should be given to the patient's desires regarding alteration in the shape of the nose whenever possible, but the surgeon should not agree to any change which is too extreme or which is physiologically unsound.

About 6% of well-managed rhinoplasties require secondary adjustments, which can be done in the office with the use of local anesthesia. It is best to warn the patient of this possibility before operation.

A careful examination of each nasal cavity should be made after the rhinoplasty has been completed to determine the functional capacity of the nose. The vast majority of properly selected patients will be satisfied with a reasonable degree of improvement in their appearance provided they have adequate breathing space and no obstruction to normal sinus drainage.

CONCLUSIONS

1. The modern rhinoplasty for correction of the oversized nose is satisfactory to patients in about 94% of the cases. Secondary operations will benefit most of the dissatisfied patients.

2. In our hands general anesthesia is preferable to local anesthesia.

3. It is advantageous to combine the rhinoplasty with a submucous resection and trimming of the turbinates when the latter are necessary to provide good breathing space and adequate room for sinus drainage.

4. Overcorrection of a deformity should always be avoided, since patients are not benefited by a radical change in their appearance.

5. A good postoperative result is a reasonable degree of improvement in appearance and a normal-looking nose which does not appear as though it had been operated upon.

15 Washington St. (2).

PRIMARY MUCOEPIDERMOID CARCINOMA OF MASTOID

Report of a Case

LEIGHTON F. JOHNSON, M.D.
AND
M. STUART STRONG, M.B., F.R.C.S.(Eng.)
BOSTON

WHILE primary carcinoma of the middle ear is known to be of relatively common occurrence, primary carcinoma of the mastoid without involvement of the antrum or the tympanic cavity is a medical curiosity.

Cases of primary malignant disease limited to the mastoid were encountered on three occasions in the literature of the past 20 years. Lillie [1] briefly reported a case of "primary carcinoma of the mastoid," which he encountered, without giving any histopathological details. Corya [2] recorded a case of osteogenic fibrosarcoma of the temporal bone which involved the posteroinferior part of the mastoid. Scal and Ide [3] described a case of angioendothelioma of the mastoid in a child of 21 months. Both of the latter two cases presented facial paralysis and a polyp protruding through the posterior wall of the external auditory meatus without involvement of the middle ear.

REPORT OF CASE

A 79-year-old white man presented the chief complaint of a tender swelling behind his ear, which had been present for two months.

The past history included a partial gastrectomy, in 1938, for treatment of a benign peptic ulcer, a fractured hip, in 1946, which was pinned, and prostatectomy, in 1947, for treatment of benign prostatic hypertrophy, and, in 1947, he was found to have generalized senile osteoporosis, with a crush fracture of a lumbar vertebra. At no time was there any evidence of malignant disease.

Examination revealed a firm smooth ill-defined tender swelling about 5 cm. in diameter over the left mastoid. The tympanic membrane and hearing were normal. Facial movements were normal. A thorough physical examination revealed no relevant disease.

A roentgenogram of the mastoid (Fig. 1) showed a large radiolucent defect which had completely obliterated the mastoid cells, without involving the periantral cells. Scout films revealed

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Read by invitation before the New England Otolaryngological Society, Boston, June 18, 1952.

Professor of Otolaryngology, Boston University School of Medicine, and Chief of Service, Massachusetts Memorial Hospital (Dr. Johnson); Instructor in Otolaryngology, Boston University School of Medicine, and Assistant Surgeon, Massachusetts Memorial Hospital (Mr. Strong).

1. Lillie, H. I.: Surgical Report for 1936 of the Section of Otolaryngology and Rhinology, Proc. Staff Meet., Mayo Clin. **12**:337-349, 1937.

2. Corya, H. W.: Osteogenic Fibrosarcoma of the Temporal Bone, Laryngoscope **51**:580-585, 1941.

3. Scal, J. C., and Ide, D.: Angioendothelioma of the Mastoid: Case Report, Laryngoscope **52**:122-127, 1942.

multiple small rarefied areas in the skull but none in the long bones or in the spine. The chest film showed no evidence of lung metastases.

The differential diagnosis suggested by such a report was the following: (1) primary cholesteatoma, (2) a vascular tumor, such as an aneurysm or an angioma, and (3) primary or secondary neoplasm.

Since it was thought that further laboratory and clinical study would not be contributory, an exploratory operation was decided upon. At operation a moth-eaten cortical defect was found, with the mastoid filled with a firm avascular tumor. The lateral sinus was thrombosed and reduced to a small firm fibrous cord. The dura of the middle and posterior fossae was

Fig. 1.—The normal antrum and periantral cells are in marked contrast with the large mastoid defect.

widely exposed and seen to be closely studded with tumor nodules. A frozen section was reported as being "malignant tumor, most probably carcinoma." The lesion was obviously inoperable, so the wound was packed and left open.

After operation the patient was given a palliative course of x-ray therapy, 2,000 r being administered.

COMMENT

Evaluation of the lesion was difficult, and three possibilities were considered: (1) primary malignant tumor in the mastoid, (2) extension of malignant disease from the meninges, and (3) metastasis from a distant primary malignant tumor.

Since no evidence of a primary malignant tumor elsewhere was forthcoming, the lesion was considered to be a local malignant tumor in the mastoid region which had metastasized throughout the calvaria via the diploic veins.

The tumor could have arisen from one of two types of tissue: (1) mesenchymal —osseous, connective, vascular, or meningeal or (2) epithelial—cuboidal epithelium of the lining of the mastoid cells.

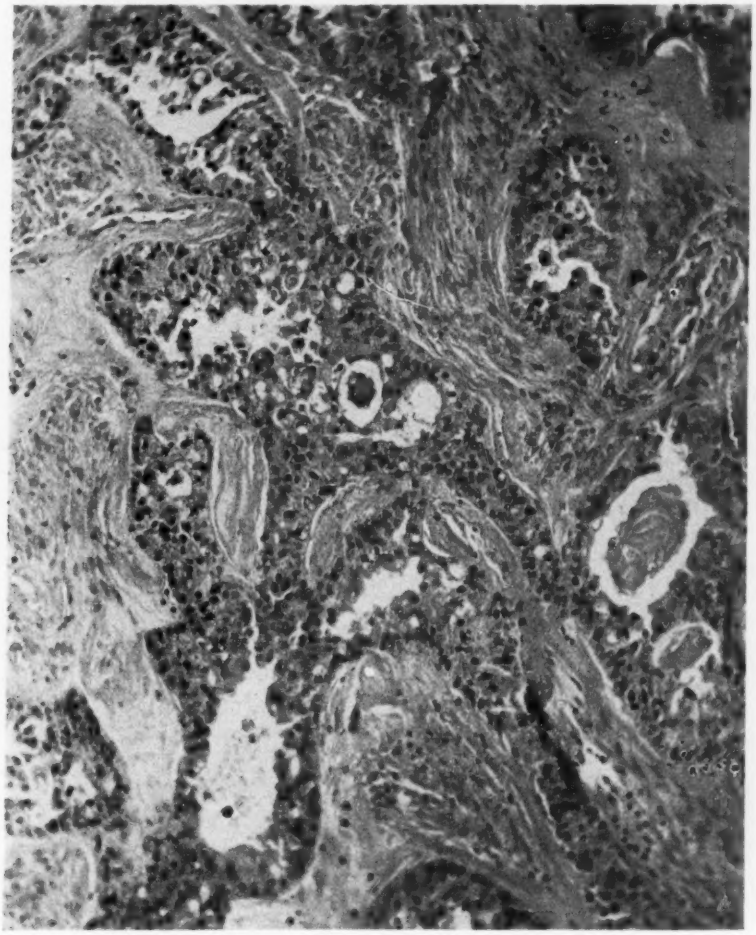

Fig. 2.—Low-power view (× 120) showing glandular pattern with epidermoid metaplasia and mucus formation.

Since so much difficulty had been encountered in deciding the exact nature of this tumor, it was decided to have the sections (Figs. 2 and 3) examined by three pathologists. The sections were stained with hematoxylin and eosin.

Dr. Rudolf Osgood reported "a definitely malignant mucus-secreting epithelial tumor, of which the appearance suggests origin in one of the major salivary glands."

Dr. Werner Mueller reported "a well-differentiated glandular pattern presenting cuboidal and columnar cells; the appearance is consistent with origin in the cubical cells of the lining of the mastoid. The tumor is definitely not of meningeal origin. The diagnosis is cylindrical-cell carcinoma (which bears no relation to the well-known cylindroma)."

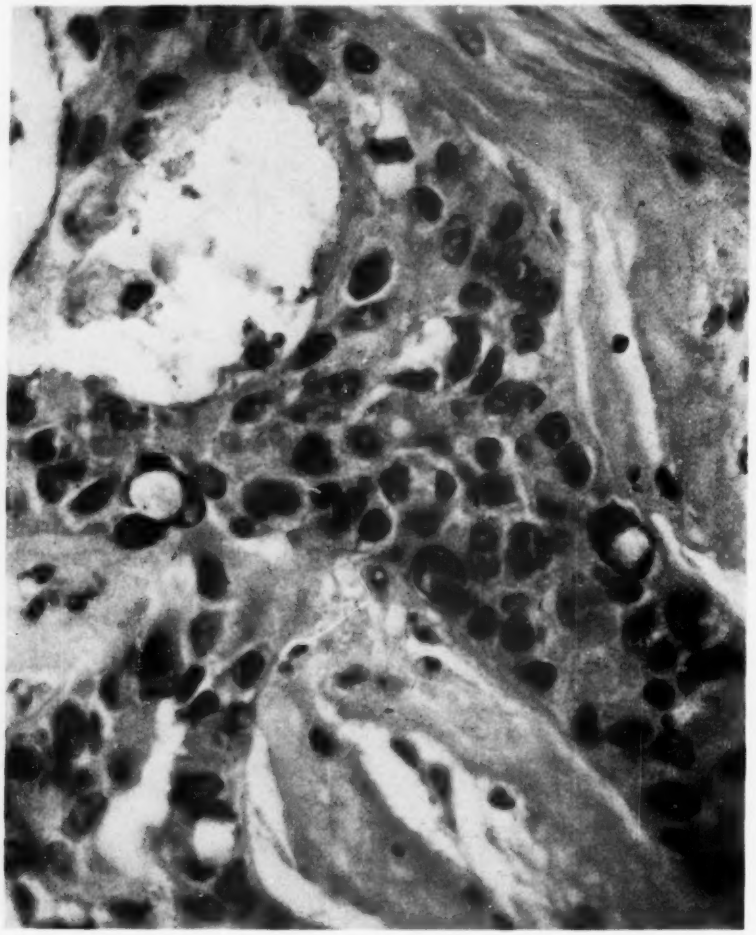

Fig. 3.—High-power view (× 420) showing numerous mitotic figures.

Dr. Olive Gates reported as follows: "The tumor is definitely of epithelial origin, being partly keratinized and partly glandular. There is some mucus formation. It appears to be akin to that seen in the upper respiratory tract and in relation to the salivary glands. It is moderately malignant and could metastasize. The diagnosis is mucoepidermoid carcinoma."

In 1949, Owens [4] recorded 13 cases of primary tumor of the middle ear of salivary gland origin. The occurrence of these tumors is difficult to understand because, as Wolff [5] has emphasized, there are no glands in the middle ear lining distal to the aural end of the Eustachian tube.

A little reflection on the embryonic development of the region, however, helps to elucidate the problem. The entire oropharyngeal region of the adult is closely studded with small seromucinous glands, the minor salivary glands. This region is derived mainly from the first pharyngeal pouch, which also gives rise to the Eustachian tube and the middle ear. The lining of the mastoid is merely an extension of that of the middle ear. Consequently, it would seem permissible to postulate that any tumor arising in this region with characteristics of salivary gland origin could have arisen from cells which had retained some of the developmental potentialities of the primary germ layer, the pharyngeal entoderm. This postulate would explain the occurrence of such tumors in the mastoid.

Stewart, Foote, and Becker [6] have given a very complete description of mucoepidermoid tumors of salivary gland origin. The characteristic features are mucous cells occurring in association with epidermoid metaplasia in basal, mucous, and columnar cells. The greater the degree of malignancy, the more epidermoid metaplasia is seen to predominate. The lesion in this discussion appears to present these features.

SUMMARY

An unusual case of primary mucoepidermoid carcinoma of the mastoid, without involvement of the middle ear or of the mastoid antrum, is described. The histopathology is discussed.

4. Owens, H.: Minor Salivary Gland Tumors in the Respiratory Tract and Ear: Review of Literature and Report of 2 Cases, Laryngoscope **59**:960-983, 1949.

5. Wolff, D.: Vascular Pathology of the Temporal Bone, Tr. Am. Acad. Ophth. **54**:37-64, 1949.

6. Stewart, F. W.; Foote, F. W., and Becker, W. F.: Muco-Epidermoid Tumors of Salivary Gland, Ann. Surg. **122**:820-844, 1945.

ORGAN OF CORTI AS WE SEE IT TODAY, ONE HUNDRED YEARS AFTER ITS DISCOVERY

DOROTHY WOLFF, Ph.D.
NEW YORK

MICHAEL PUPIN once said that Americans should establish the custom of observing memorial days in honor of great scientists of the past so that our younger generations would learn about and appreciate the contributions of distinguished men of previous generations.

The otolaryngologists of the College of Physicians of Philadelphia are to be congratulated for their present concern with the contribution of Alfonso Corti one hundred years ago. Philadelphia has shown itself in the past to be interested in the ear. According to Ullman, Dr. Joseph Leidy, Professor of Anatomy in the University of Pennsylvania, was enthusiastic about Corti's paper when it appeared. Philadelphians had the foresight to procure the incomparable museum collections exhibited here this evening. Your eminent Dr. George A. Piersol, who succeeded Leidy, was the first American author of gross anatomy to include illustrations of microscopic sections of the temporal bone in his text. Furthermore, the pictures were drawn from a specimen in the collection of and prepared by Dr. Ralph Butler of this city.

You are doubtless familiar with the life of Corti, especially since the publication of Ullman's paper.[1] It is interesting to note that as recently as 1907 Dr. Max Neuberger could say, "Corti belongs to those whose name is on everyone's lips and of whose life nothing is known" (translated from the German).[2] Schaffer, in 1914, published information on the life of Corti,[2] and Pincherle, in 1932, gave additional information. From these and other sources[3] we know that Corti undertook the study of medicine in the University of Pavia in 1841, against the wish of his father, a nobleman.

He studied under Panniza, successor of Scarpa, whom Corti doubtless knew personally, since Scarpa is said to have been a frequent visitor in the home of Corti's father. Panniza, like Scarpa, had dissected the membranous labyrinth. He was already giving instruction in the use of the compound microscope and in microscopic anatomy when Corti was his student. In fact, Amici, a fellow countryman, had, in

From the Lempert Institute of Otology.

Read before the Philadelphia College of Physicians, Nov. 21, 1951, as a part of a centennial program in honor of the publication (1851) of Corti's contribution on the anatomy of the membranous cochlea.

1 Ullman, E. V.: Life of Alfonso Corti, A. M. A. Arch. Otolaryng. **54**:1-28 (July) 1951.

2. Schaffer, J.: Marchese Alfonso Corti: Ein biographischer Versuch, Anat. Anz. **46**:368-382, 1914.

3. Peyser, A.: Vom Labyrinth Ausgesehen: Plaudereien über unser Ohr als Kulturgut, Zurich, Europa Verlag A. G., 1942.

1840, invented the water-immersion lens. Whether or not Corti knew of this instrument is not known.

Rosconi, another of Corti's professors at Pavia, had devised the vascular injection technique, and this method was introduced by Corti in Vienna, where he went

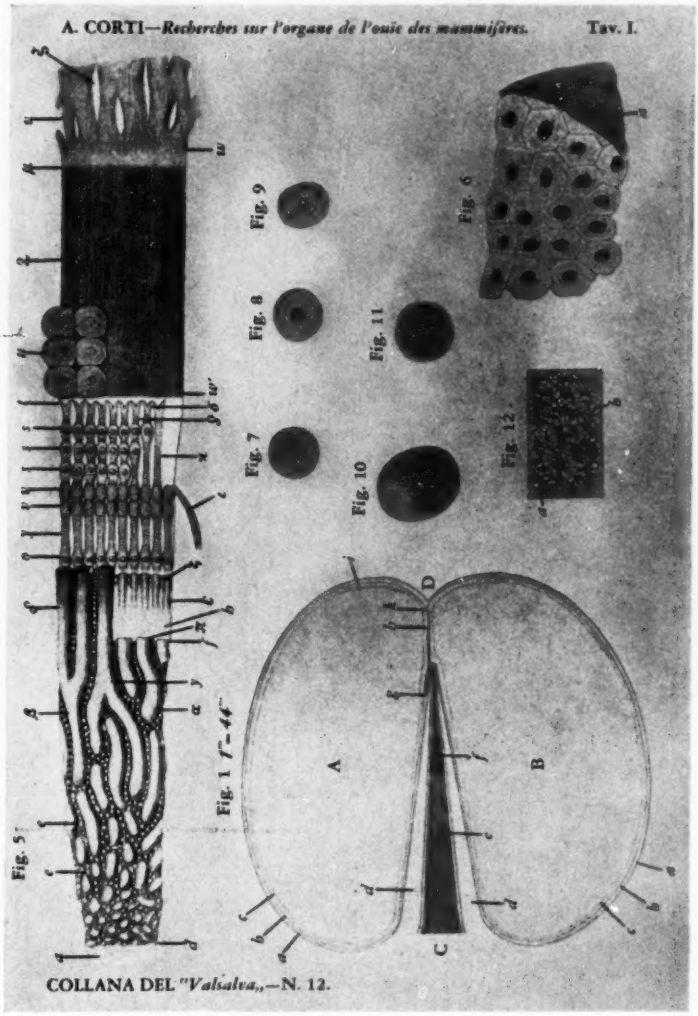

Fig. 1.—Plate I from Corti's work.

to complete his scientific education. Corti prepared many injection specimens for museum demonstrations for the great comparative anatomist, Hyrtl. Most of these were destroyed by fire during the political uprising in 1848, and the rest are said to have been finally lost to posterity during World War II. From the exhibit here this evening you see that the College of Physicians is the proud possessor of Hyrtl's com-

plete collection of forty-nine specimens of bony labyrinths representing as many different mammals. Hyrtl's monograph describing these specimens appeared the year after Corti went to Vienna. Since Corti's time during his first year in Vienna was presumably occupied with medical courses and the preparation of injection specimens,

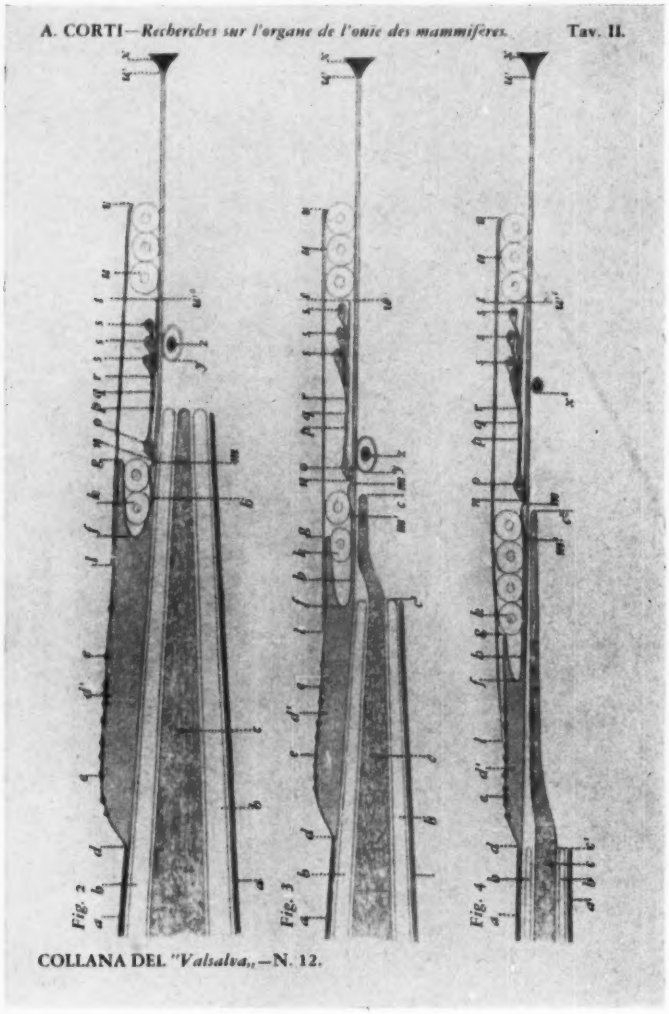

Fig. 2.—Plate II from Corti's work.

we may assume that he was not working specifically on the ear. He took his medical degree in Vienna in 1847, and thereafter he became prosector and a member of the teaching staff in Dr. Hyrtl's department. In this capacity he began his work on the membranous ear.

The dissertation on the membranous labyrinth was published after Corti left Vienna and is the third among the four papers written by him. His contribution

Explication des figures.

(Table IV et V).

Fig. 1. Figure ideale d'une tranche verticale du premier tour du limaçon dans son commencement près du vestibule grossie 15 fois environ. (Chats, chiens.)

A. Rampe vestibulaire.

B. Rampe tympanique.

C. Endroit dans lequel la lame spirale osseuse se détache de l'axe du limaçon.

D. Lamina spiralis ossea accessoria (*Huschke*) se continuant dans les parois osseuses du limaçon.

a. (Ligne noire.) Surface interne de la paroi osseuse du limaçon.

b. (Ligne jaune.) Periostе qui tapisse la cavité des deux rampes.

c. (Ligne ponctuée.) Couche epithéliale etendue sur le periostе.

d. d. Lame spirale osseuse.

e. Canal nerveux de la lame spirale osseuse renfermant les faisceaux de l'expansion du nerf cochléen.

f. Bandelette ganglionnaire. (*Habenula ganglionaris laminae spiralis cochleae.*)

g — h. (Couleur bleue.) Lame spirale membraneuse.

g — h. Zône dentelée.

h — k. Zone pectinée.

i. (Ligne rouge.) Bande vasculaire. (*Stria vascularis.*)

Fig. 2, 3 et 4. Figures ideales de tranches verticales de la lame spirale membraneuse, grossies 450 fois environ. (On a ôté la couche epithéliale qui tapisse la surface vestibulaire de la lame spirale membraneuse et celle qui en tapisse la surface tympanique. Chats, chiens.)

Fig. 2. Tranche verticale de la lame spirale membraneuse imaginée dans son commencement près du vestibule.

a. a. (Couleur bleue.) Periostе qui tapisse la lame spirale osseuse.

b b. Lame spirale osseuse près de son bord libre.

c. Faisceaux de l'expansion du nerf cochléen renfermés entre les deux lames osseuses (*b. b.*) qui forment le bord libre de la lame spirale osseuse.

d — w. (Couleur jaune.) Lame spirale membraneuse.

d — w'. Zône dentelée. (*Zona denticulata.*)

d — d' — f. Bandelette sillonée. (*Habenula sulcata.*)

d. Endroit ou le periostе de la surface vestibulaire de la lame spirale osseuse change de structure et s'épaissit (*marche spirale*) pour former la bandelette sillonnée.

e. Globules qui remplissent les sillons de la bandelette sillonée.

f — g. Dents de la première rangée.

g — f — h. Sillon spiral (*sulcus s. semicanalis spiralis.*)

h. Paroi inférieure du sillon spiral.

k. Cellules épithéliales placées sur la portion interne de la bandelette dentelée, et dont quelques unes bouchent le sillon spiral à son ouverture.

h — w'. Bandelette dentelée. (*Habenula denticulata.*)

h — m. Dent apparente.

n — t. Dents de la deuxième rangée.

n — p. Branche postérieure des dents de la deuxième rangée.

o. Grossissement de l'extrémité postérieure de la branche postérieure des dents de la deuxième rangée.

p — q et *q — r.* Coins articulaires.

r — t. Branche antérieure des dents de la deuxième rangée.

s. s. s. Cellules d'épithelium cylindrique placées sur la branche antérieure des dents de la deuxième rangée.

t — v. Membrane qui sert de toit à la bandelette dentelée.

t. Dents de la première rangée.

v. Endroit ou une excroissance cylindrique se prolonge au dehors de la bandelette sillonée, et devient une dent de la première rangée. (J'ai coupé ici, et enlevé cette dent de même que les deux autres qui se trouvaient à ses côtés, pour mettre à découvert l'origine de la bandelette dentelée.)

x. Dent apparente.

ζ. Trous percés dans la bandelette dentelée entre les dents apparentes.

z. Branche postérieure d'une des dents de la deuxième rangée.

γ. Coins articulaires.

r. Branche antérieure d'une des dents de la deuxième rangée, de laquelle j'ai ôté les trois cellules d'epithelium cylindrique.

α. Branche antérieure d'une des dents de la deuxième rangée de laquelle j'ai ôté les deux premières cellules d'epithelium cylindrique pour en faire voir la troisième dans toute son étendue.

ε. Branche antérieure d'une des dents de la deuxième rangée de laquelle j'ai enlevé la première cellule d'epithelium cylindrique afin de faire voir la seconde cellule dans toute son étendue.

ι. Branche antérieure d'une des dents de la deuxième rangée repliée en arrière, et en partie sur les coins articulaires.

ρ. Grossissements cylindriques de la zône pectinée.

w' et *w* Origine des grossissements cylindriques aux deux bords de la zône pectinée.

u. Une des cellules épithéliales qui se trouvent entre la zône pectinée et la membrane qui sert de toit à la bandelette dentelée.

w' — w. Zône pectinée (*zona pectinata*).

x. (Couleur bleue.) Periostе qui tapisse la *lamina spiralis ossea accessoria*, et dans lequel la lame spirale membraneuse a son insertion.

y. Vas *spirale (internum)*. *z.* Sa tunique interne.

Fig. 3. Tranche verticale de la lame spirale membraneuse, imaginée après qu'elle a atteint 6" de longueur environ depuis son origine dans le vestibule. (Les mêmes lettres indiquent les mêmes objets que dans la fig. 2.)

m' — m. Dent apparente.

c' — c''. Expansion du nerf cochléen etalée sur la surface tympanique de la bandelette dentelée après être sortie de la lame spirale osseuse.

Fig. 4. Tranche verticale de la lame spirale membraneuse imaginée à 0,5" environ avant sa dernière terminaison dans le sommet du limaçon (les mêmes lettres indiquent les mêmes objets que dans la fig. 3.)

z'. Vas *spirale internum* à simples parois.

Fig. 5. Surface vestibulaire de la lame spirale membraneuse dans son origine pris du vestibule, regardée à vol d'oiseau, et grossie 450 fois environ. (Les mêmes lettres indiquent les mêmes objets que dans la fig. 4. Chats, chiens.)

d — f. Bandelette sillonée.

t. Extrémité antérieure ou externe des dents de la deuxième rangée.

v. ζ. Excroissances cylindriques de la bandelette sillonée.

ν. Colonnes fibreuses au moyen desquelles le periostе reçoit l'insertion de la lame spirale membraneuse. (Ces colonnes etaient adherentes à la paroi osseuse du limaçon dans la rampe vestibulaire et tout près de la *lamina spiralis ossea accessoria*; nous les avons etalées sur le même niveau que la lame spirale membraneuse pour faire voir leur disposition à mailles. De telles colonnes se trouvent aussi dans la rampe tympanique et dans les mêmes rapports avec la paroi du limaçon et avec la lame spirale membraneuse, que dans la rampe vestibulaire.)

λ. Lacunes ou ouvertures qui se trouvent entre les colonnes fibreuses du periostе près de l'insertion de la lame spirale membraneuse dans le periostе même.

Fig. 6. Couche epithéliale qui tapisse la cavité du limaçon observée dans une solution de sucre médiocrement concentrée, et extraite du limaçon d'un animal encore tout chaud. (Mouton.)

a. Une partie de cette couche epithéliale repliée sur elle-même.

Fig. 7. Une cellule epithéliale dont le noyau beaucoup plus grand qu'à l'ordinaire est arrondi et ne contient pas de nucléoles.

Fig. 8. Une cellule epithéliale isolée et traitée avec de l'eau.

Fig. 9, 10 et 11. Cellules epithéliales renfermant des grains de pigment brun en quantité plus ou moins considérable. (Elles sont parsemées entre les cellules epithéliales ordinaires qui enveloppent la bande vasculaire du periostе des parois du limaçon — (*Stria vascularis.*)

Fig. 9. Cellule dans laquelle il n'y a qu'un nombre très petit de grains de pigment.

Fig. 10. Cellule à moitié remplie par les grains de pigment, et dans laquelle le noyau est encore visible.

Fig. 11. Cellule complètement remplie par les grains de pigment. On y voit encore la membrane de la cellule sous la figure d'une ligne transparente qui entoure la cellule même. Le noyau en est entièrement caché par les grains de pigment; la place ou il se trouve est cependant encore reconnaissable parceque le contenu de la cellule y est d'une couleur un peu moins foncée.

Fig. 12. Lame osseuse médiocrement mince extraite de la lame spirale osseuse du limaçon, et grossie 350 fois environ.

a. Corpuscules osseux ordinaires.

b. Corpuscules osseux qui s'anastomosent entre eux.

Fig. 3.—Corti's key to his drawings.

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on the retina was brief. He illustrated that paper with only three or four drawings of the nerve cells which are now designated the rods, cones, and horizontal cells of the eye. He made no mention of technique except to say that he placed the eye tissue in chromic acid solution for three months prior to dissection. Some students of his life have felt that Corti worked on the eye first to develop techniques for his more difficult task on the ear. I have seen no intimation of this. The two-page article on the retina stands in marked contrast to the very next treatise in the periodical, written, oddly enough, by Helmholtz. Helmholtz' 138-page article contains column after column of figures and several mathematical formulae for the calculation of the speed of conduction of nerve fibers, as well as a discussion of this phenomenon in relation to the activity of a magnet.

Thus, these two investigators, Helmholtz and Corti, men whose work was destined to have profound influence on our knowledge of the ear, must have at least been familiar with each other's names at the very outset of their careers. Helmholtz' paper on physical acoustics appeared in 1854, just three years after Corti's paper on the ear. It was devoted more specifically to middle ear and drum membrane functions. In later works when Helmholtz was formulating his resonance theory in detail, he referred to Corti's work. In one place he spoke of "tense and resonating bands," and, according to Wever, he referred to "little plates" and "elastic plates and hairs," undoubtedly referring to Corti's description of the surface of the specialized epithelium on the "vestibular side" of the basilar membrane.

Corti's thesis entitled *Recherches sur l'organe de l'ouïe des mammifères* is less well known today than it should be, and its value as a contribution to our knowledge of the membranous labyrinth is poorly appreciated. I shall attempt to evaluate the work and to illustrate by photographs some of the structures which Corti described in the text. Corti's illustrations (Figs. 1 and 2) appear more like those of a draftsman, like the technical "working drawings" of a trade, than they appear like those of a biologist or a medical student. Nevertheless, study of them with the accompanying key (Fig. 3) is highly rewarding. Perhaps in the more familiar medium of photomicrography the accuracy of his observations and descriptions can be better appreciated.

Undoubtedly Corti would have derived some amusement could he have seen the assiduous effort expended first to find and then to photograph subject matter he had described one hundred years before our time. While reading his monograph, and especially his footnotes, we realize that we have frequently seen these details, but to get the camera to portray a three-dimensional structure under the microscope is a problem. Some clarifications, particularly on the formation of outer pillars and on the "lace-like" nerve terminations, are here contributed; also, the double chain of nonmyelinated nerve fibers running along each side of the tunnel, another detail Corti could not see, is described.

Corti intended his paper on the ear to be one of a series on that subject. He stated in his Footnote 1 that he hoped to contribute studies on the relationship of the anatomy, physiology, and chemistry of this organ. We now know that the crippling arthritis deformans which burdened his later life had already set in. No more baffling disease could have attacked a scientist who depended upon precision movements for minute dissection and microscopic focusing. No second paper by Corti ever appeared on the ear.

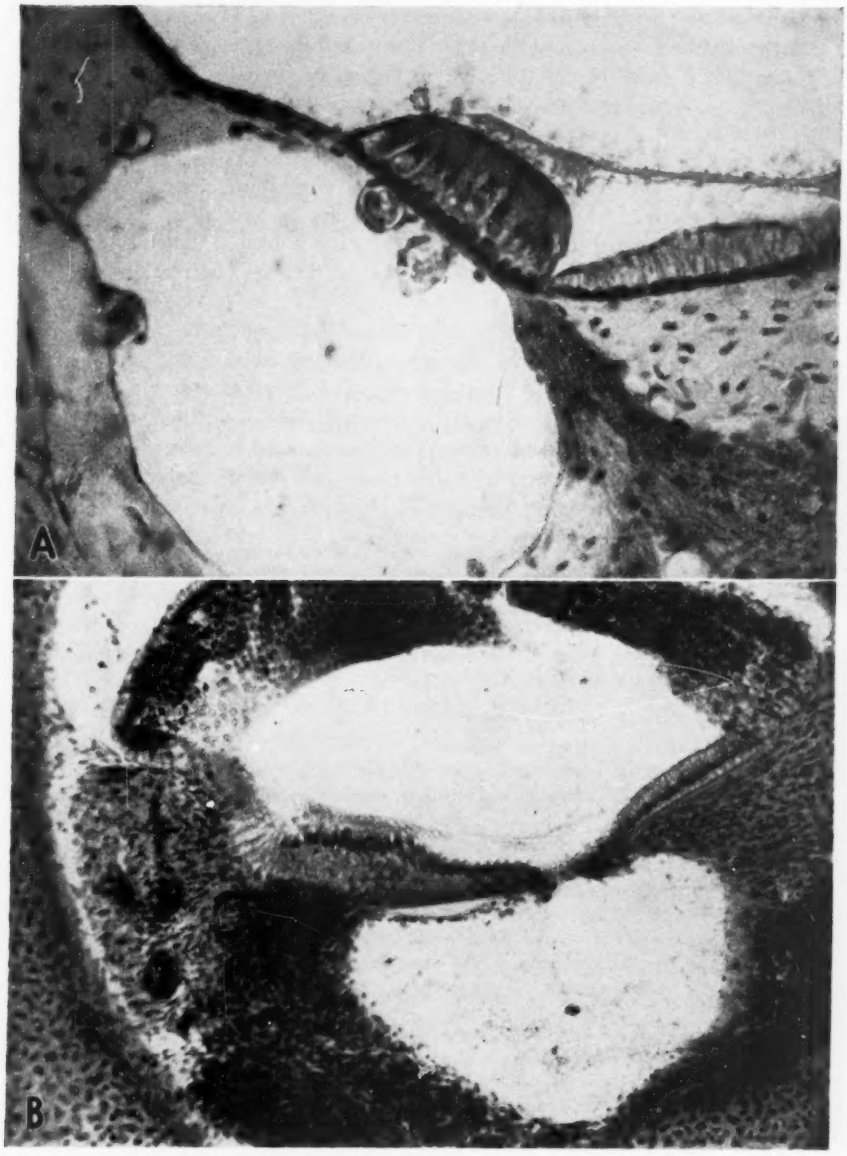

Fig. 4.—*A*, the organ of Corti in a turtle. Such a mound of specialized epithelium was observed in the bird and other animals by Scarpa, Huschke, etc., as Corti stated; note that in the turtle, as in the bird, there are no pillars and therefore there is no tunnel; tectorial membrane is present. *B*, the organ of Corti in a bird. Note the absence of pillar cells and tunnel; tectorial membrane is apparent at the left.

In this study Corti devoted his attention to the membranous cochlea, since, as he said, the bony structure had been accurately described by Hyrtl and others. He did not stress the description of the organ now called the organ of Corti more than any other detail which he described except in that its complexities required more attention. He was fully aware, and so stated, that Scarpa, Huschke, and others had observed a mound of specialized epithelium on the lamina spiralis membranacea (basilar membrane). My Figure 4 illustrates such a mound as seen in a turtle (*A*) and a bird (*B*). It is noted that in the turtle, as in the bird, there are no pillars and therefore there is no tunnel. Corti in describing the specialized epithelium in mammals made no boastful announcement, not even a modest statement, that he was observing detailed anatomy for the first time or that his observations were the first to appear in the literature.

The main body of Corti's contribution covers less than thirty-two pages. The bulk of the work lies in twenty-five additional pages published in fine print as footnotes, numbering fifty-seven. Without knowledge of the content of these footnotes no proper appreciation of the value of Corti's study can be attained, for they are more voluminous than the main paper. They are devoted to controversial points wherein he referred to and accredited generously many contemporary and earlier investigators.[4] In the thesis proper Corti employed for the most part the editorial

4. These references, Corti's bibliography, were scattered throughout his main paper and footnotes:

Bendz: Handboog i den almendelige anatomie, Copenhagen, 1847.

Bidde and Reichert (no text cited).

Breschet, G.: Recherches anatomiques et physiologiques sur l'organe de l'ouïe et sur l'audition, dans l'homme et animaux vertébrés, Ed. 3, 1840.

Corti, A.: Beitrag zur Anatomie der Retina, Arch. Anat., Physiol. u. wissensch. Med., in Müllers Archiv, 1850, Pt. 3, pp. 273-275.

Hacken: Crista spiralis acustica (no text cited).

Hannover, A.: Recherches mic. sur le système nerveux, Copenhagen, P. G. Philipsen, 1844.

Harting: Het mik. dezelfs gebruch geschiedens en tegenwordie, Wesland Tweede decl., p. 347.

Hildebrandt, G. F., and Weber, E. H.: Soemmering (Abbildung des Gehörorganes, etc.).

Huschke, E.: Über das Gehörzähne einen eigenthumlichen Apparat in der Schnecke des Vogelohrs, Arch. Anat. u. Physiol., 1835, p. 335.

Lehre von den Eingeweiden und Sinnesorganen des Menschen Körpers, 1844.

Hyrtl, J.: Vergleich. anatomische Untersuchungen über das innere Gehörorgan des Menschen und Säugethiere, 1845.

Jones, W.: The Organ of Hearing, in Todd and Bowman: Cyclopedia.

Kölliker, R. A.: Mikroscopische Anatomie des Menschen, Pt. 1, Ztschr. wissensch. Zoologie, Vol. 1, p. 56.

Krause, C. F.: Handbuch der menschlichen Anatomie, Hannover, Hahn, 1833-1838.

Meckel, P. F. T.: De labyrinthi auris contentis, Argentorati, J. H. Heitzii, 1777, pp. 15-16.

Morgagni, J. B.: Epistolae anatomicae XII, p. 18.

Mulder and Donders: Holländische Beiträge, Vol. 1.

Pappenheim: Froriep's Notizen, 1838, No. 141.

Raspail, F.: Nouveau système de chimie organique, fondé sur des méthodes nouvelles d'observation, Paris, J.-B. Baillière, 1833, p. 289.

Reichert: Jahresbericht uber die Fortschritte der Histologie, Müllers Archiv, 1848.

Scarpa, A.: Anatomicae disquisitiones de auditu et olfactu, Ticini, P. Galeatii, 1789, p. 50.

Scarpa and Hacken (no text cited).

Schroeder van der Kolk and Harting (no text cited).

Schwann, T.: Mikr. Untersuch. über die Übereinstimmung in der Struktur u. d. Wachstum der Thiere u. Pflanzen, p. 135.

"we" (*nous*); in the footnotes he used the familiar "I" (*je*). Here he also gave his technique, although not in specific detail, and he told of his difficulties. In his Footnote 1 he rather wryly remarked,

> The difficulty of the present work on the soft parts of the organ of the ear . . . is sufficiently evident if one considers the slight results of those anatomists who have occupied themselves with this [subject] up to the present.

Corti's paper was published in the French language in a German periodical, *Zeitschrift für wissenschaftliche Zoologie* (3: 106-169, 1851). According to Ullman, the work was written in Italian and translated into the French by Corti himself. Indications are that some of the original notes may actually have been written in German, since he occasionally used the inverted word order so characteristic of that language.

It seems apparent that more work needs to be done from a historical point of view on the work of Corti. For instance, Ullman leaves us with the impression that Corti had dissected only twenty specimens taken from the dog, cat, mouse, and rat but that he wanted two hundred. Ullman does say that in Paris Corti intended to add specimens of the cochlea of the bull, pig, lamb, rabbit, mole, squirrel, and bat. Corti himself said,

> The observations contained in this dissertation are the result of studies made over a long period on at least 200 cochleae of the bull, pig, sheep, cat, dog, rabbit, mole, two species of mice, and man.

I assure you that no one could have recorded the excellent detail that Corti saw on the basis of twenty dissections. He apparently did not have the technique for embedding and may not have decalcified the bone, although he used hydrochloric acid. It is interesting to know that Reissner, a student-contemporary of Corti and also working with Hyrtl, definitely stated that he (Reissner) decalcified the bone. Corti spoke of making sections, and his Figure 1 shows that he thoroughly understood the anatomy of a section of one turn of the cochlea, with the exception of the existence of the membrana vestibularis (Reissner's membrane). My Figure 5*A* shows one coil of the cochlea as we see it today.

Corti used, as you will note from the key to his illustrations, magnifications ranging from 20 and 30 times up to approximately 350 and 450 times. He dissected fresh specimens, preferring to obtain them while the animal's body was still warm because degeneration set in so quickly. He noted deterioration within an hour, and in five or six hours the parts were unrecognizable. For this reason, he realized that his observations on human material could not be as accurate as those on lower animals, but he saw no essential differences between the structures in man and those of other mammals.

Corti was meticulously precise in his measurements of such minutiae as the pigment granules within the cells of the stria vascularis but annoyingly casual when

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Todd, R. B., and Bowman, W.: The Physiological Anatomy and the Physiology of Man, London, J. W. Parker, 1845-1859, Pt. 3.

Treviranus: Ztschr. Physiol., Vol. 1.

Valentin, G.: Soemmering's Anatomie, Nervenlehre.

Virchow, E. H., and Rheinhardt: Arch. path. Anat., Vol. 1, p. 20.

Wagner and Robin (no text cited).

Weber, E. H., and Hildebrandt, G. F.: Handbuch der Anat. des Menschen, Stuttgart, 1830-1832, Vol. 4.

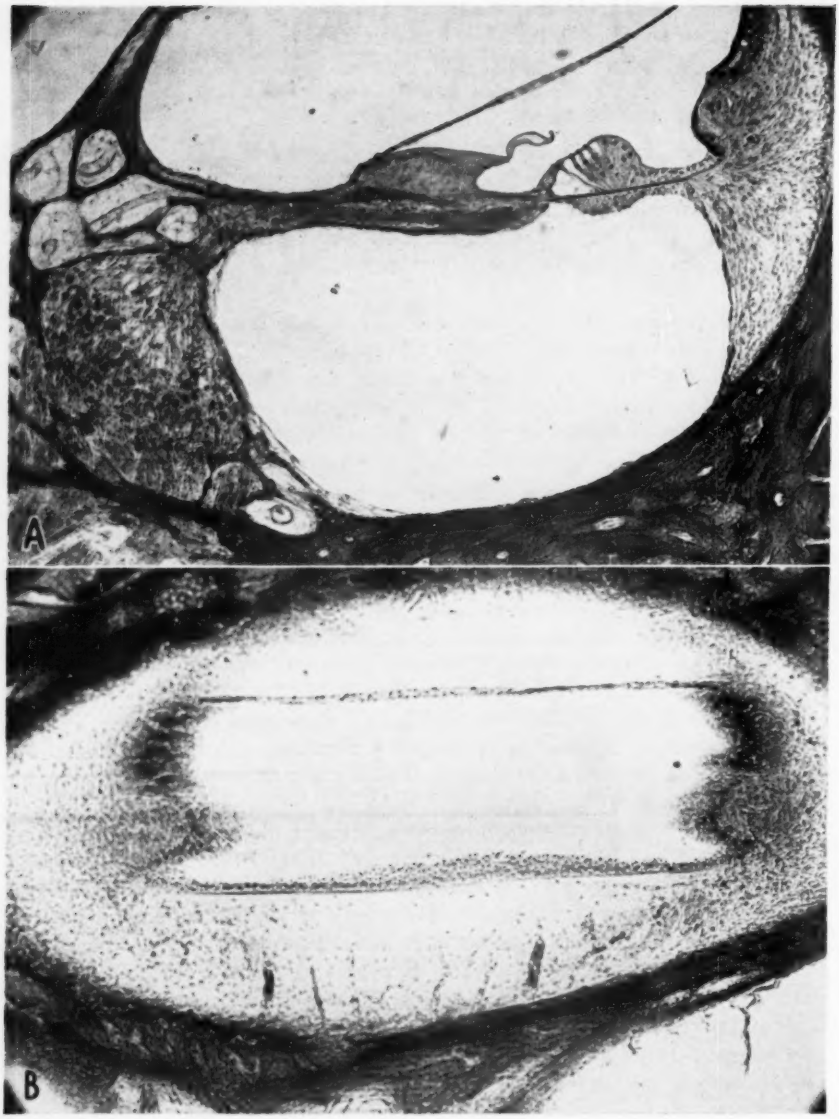

Fig. 5.—*A*, basal coil showing nerve fibers and undulating blood vessel passing through the bony spiral lamina. Note the cut ends of Rasmussen's bundle of fibers just above the ganglion cells; tunnel fibers are also apparent. Monkey 17; Rt. 221. *B*, tangential surface cut of the spiral ligament, or "periosteum," as Corti called it. Note the numerous blood vessels running parallel to the long axis of the cochlea. Monkey 17; Rt. 191.

he described the medium in which he examined the structures. For instance, when describing the fluid used for studying the ganglion cells, he said he took equal amounts of sugar and alcohol (alcohol percentage unstated) and sufficient carmine to stain slowly. Corti was the first to use carmine as a biological stain. He also treated his tissues with acetic acid, hydrochloric acid, ether, and salt solutions. He seemed greatly delighted when he finally learned to put a delicate piece of tissue, the *habenula dentelée,* in fluid surrounded by a gum preparation and between two pieces of glass (his Footnote *27*).

The first subject discussed in Corti's disquisition is entitled "Periosteum." In Corti's time the term "endosteum" was not used to designate the lining of the bony wall of the inner ear. In fact, this terminology was not commonly employed until modern times, when it was adopted particularly in literature on the fenestration operation. Corti evidently approached his work by removing the bony cochlear wall. In his description of the periosteum he included a description of the spiral ligament, as well as the blood vessels entering it from the bony cochlear wall. As we see it today, such anatomy is shown in my Figure 5*B*. Corti noted in his Footnote 6 that Todd and Bowman had considered this structure to be a muscle but he could never find any cells therein that resembled smooth muscle cells. He found only connective tissue cells, as had Kölliker. Kölliker had named the structure "ligamentum spirale," which Corti considered correct. Corti was not able to see a large vein in this structure as described by Breschet, but he did find the tissue highly vascular. He treated the tissue with sugar solution in order to bring out the elaborate meshwork of vessels which he observed running more or less parallel to the long axis of the cochlea.

Corti observed the manner in which the cells of the spiral ligament fused to form "columns," or "pillars," just as they entered the basilar membrane. These he illustrated in his Figure 5, to the extreme right, labeled *w* and *v*. As we see this structure today, it is illustrated in my Figure 6*A*, the specimen taken from the mouse. The apertures between these fusiform structures were discussed by Corti, and he soliloquized as to whether or not their presence meant that the fluid from the scala tympani could pass through these to the scala vestibuli. Nowadays we should have to think whether or not they permitted the fluid of the scala media to communicate with the scala tympani. At this point I should like to state that these bundles of fibers form the sheet of fibers composing the basilar membrane, as illustrated in Corti's Figure 5, 2, and then unite in groups of three or four, as illustrated in my Figure 9*A*, to form the outer rods, or pillars. Further details will be given in the discussion of the basilar membrane, details here presented in the literature for the first time, so far as I am aware.

The second subject which Corti discussed was the epithelium which he said covered the free surface of the periosteum, as well as the spiral lamina. Here he described and illustrated what we call sulcus cells. The cells of this tissue he found to be exactly like those found upon the internal surface of the anterior wall of the crystalline capsule. From a study of his Figure 6 it seems highly probable that Corti was also seeing the cells of Reissner's membrane at this juncture. He described the granular pigment content, the large oval nuclei, and occasional large clear cells with no nucleus but a homogenous content and a wall that burst easily. He sometimes noted here angular cells with only a nucleus. Some cells he believed

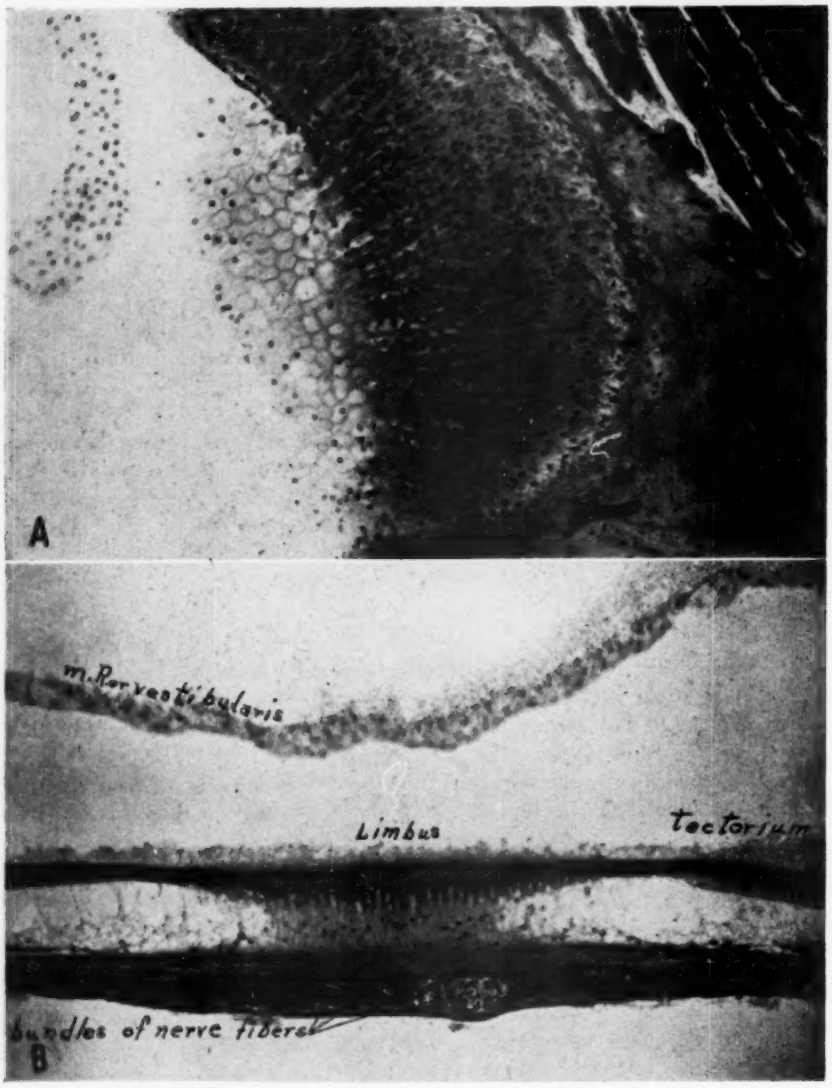

Fig. 6.—*A*, spiral ligament of the basal turn, showing "columns" of fusiform structures as they converge to form the basilar membrane. The hexagonal cells are those of the outer sulcus; a fragment of Reissner's membrane appears at the upper left. Mouse 131; Rt. 2-4. *B*, the habenula interna sulcata, or *bandolette sillonée*, later known as Huschke's teeth, now known as the limbus. Cat.

to contain drops of fat which might increase to occupy an entire cell. In his Footnote 9 he discussed the possibility of this being fatty degeneration as described by Virchow in other regions of the body.

In regard to the presence of fat as a sign of degeneration in the inner ear we now know that the inner ear is one place in the body where fatty replacement never occurs. We know also that Reissner's membrane, although but two cell layers thick, is a very complicated membrane, with rounded or hexagonal apertures in one layer and probably an intervening fluid between the two layers. The clear homogenous substance which Corti saw in some cells and the so-called fat may have been one and the same substance and may have been "lymph" in the process of secretion or of being filtered one way or the other. The only fat that Corti could possibly have seen would have had to come from the region of one or the other of the two middle ear muscles. They may sometimes atrophy and show fatty replacement. Fat is never seen in the membranous labyrinth. I observed it once in the fissula ante fenestram.

Corti's third subject for discussion is the stria vascularis. He noted that a meshwork of vessels formed a vascular band extending from base to apex of the cochlea, that vascular trunks of considerable size might divide at both ends, and that capillaries from this band might communicate with the capillaries of the periosteum. He never found arteries among the vessels of the vascular band. He observed that the whole vascular band, and consequently each capillary, was covered with epithelium.

Schaffer has clearly portrayed this epithelial tissue, as illustrated by Denker and Kahler. There is still the problem of the nature of the crypts and the manner in which the fluid secreted by these epithelial cells is poured forth, as well as the direction of the flow, to be solved. If endolymph is produced by these cells, the problem is relatively simple. If not, there are still many questions which arise today.

Corti observed melanin pigment throughout this region, sometimes as fine grains within cells, sometimes as large branching cells. These are now known to occur in the inner ears of all animals with any pigment in their coats or skin.[5] Corti saw the pigment as amorphous masses sometimes but located at almost regular intervals.

We do not know the significance of melanin in the inner ear today. No correlated study with auditory acuity in cases of albinism in humans or in lower animals has revealed any association, but such studies have been meager. There may be some association with the principle of radiation of black bodies, since melanin is distributed more or less throughout nerve tissue and may accumulate to pathological degrees. Melanin is said by modern embryologists to arise in the neural crest cells in the embryo. Melanin may accumulate to a pathological degree to form a melanoma or melanosarcoma, but these have very rarely been reported in the ear.

The second portion of Corti's paper is devoted to the subject of the lamina spiralis. Under subheading *a* he first described the lamina spiralis ossea which he accurately presented as a two-layered structure enclosing anastomosing canals through which the nerve fibers "expand," as he said, or are dispersed, as we would say. He noted that the nerve fibers became so small as to be invisible. At a magnification of only 20 times he was able to verify Scarpa's observation, as noted in his Footnote 13, that the lamina spiralis ossea is double. The measurements of the

5. Wolff, D.: Melanin in the Inner Ear, Arch. Otolaryng. **14**:195-211 (Aug.) 1931.

bony spiral lamina were made, as stated in his Footnote 14, on a 15-year-old cat and on an adult but medium-sized dog.

Corti then described the great vascularity of the bony spiral lamina and the relative size of vessels as compared with their bony channels, the surrounding space being usually two-thirds larger than the caliber of the vessel. The concentrated sugar solution he used for vascular studies can be recommended. These vessels as we now see them may be seen in my Figure 5*A*. Pigment was again noted in this area, even in the human, and I could not decide if it was normal or pathological. The remarkable fragility of the bone in this region was also carefully observed, and the unusual character of the "corpuscles," the lacunae and their canaliculi, was noted.

The basilar membrane was next described. Its attachment to the lamina spiralis ossea accessoria (Huschke), as illustrated in Corti's Figure 1 *D*, gives a greatly exaggerated idea of the size of this small bony ridge on the inner wall of the cochlea which occurs only at the lowest part of the cochlea. Throughout the rest of the cochlea the attachment is as already described by Corti and illustrated by our modern views in my Figure 5*A*.

Discussion as to the best terminology for the different regions of the basilar membrane, as assigned to them by Scarpa, Huschke, Krause, Weber, etc., occurred in Corti's footnotes. Corti adopted that used by Todd and Bowman, who followed Huschke. To describe the *saillies* forming a *couche spiral* on the "vestibular" side of the basilar membrane, for Corti was unaware of the presence of a scala media, he used the term "habenula denticulata."

The structure which we now designate the limbus Corti called the teeth of the first order, or series. Huschke had spoken of this structure as toothed and thought it was cartilaginous. In the description which he gave of it, however, Corti presented it as grooved and called it the *bandolette sillonée,* which is a much more accurate interpretation. He saw oval bodies, or globules (nuclei, as we now know), within the grooves in tiers and knew that the uppermost tapered and seemed to be connected with a mesh-like structure which covered the whole toothed structure. He looked in vain to find something similar to the otoliths of the vestibule within the grooves. Corti described the grooves as having cylindrical bifurcating excrescences which extended down to the first tapering globule within the groove. Thus, Corti described, in reverse order from the way it is formed, the tectorial membrane and its attachment to (really production by) the cells in the grooves of the limbus. A tangential view of this structure as we see it today is presented in my Figure 6 *B*. In young persons and sometimes in older people each groove is filled with a row, or series, of nuclei whose cytoplasm apparently flows out to form the meshwork of the acellular tectoral membrane. This production is probably similar to that of other biological products, akin to the web of the spider or the silk of the Lepidoptera larvae or even to the production of hair or nails. Corti apparently did not quite realize the function of the globules in the grooves. He did realize that the limbus was entirely free from the bony spiral lamina at the apex of the cochlea or in the region of the helicotrema. He spoke of the structure as being at the same time both very firm and very flexible. In a footnote he mentioned the fact that Huschke had called it the "crista acustica."

Under the term "habenula externa denticulata" Corti described the structure which now bears his name. With certain statements of his concerning this structure

we cannot now agree, for instance, that this structure increases in size toward the apex exactly as the limbus decreases. This relationship appears to differ in the various species of mammals, but in the cat, monkey, and man I do not find this situation in the fixed and sectioned tissue. It does appear somewhat in the guinea pig, which was not one of the animals that Corti used.

The inner hair cells were described as a row of single cylindrical projections, *saillies cylindriformes*, and illustrated in his Table IV, Figure 2 *h-m*, Figures 3 and 4 m^1-*m*, and in Table V, Figure 5 *e* (Fig. 7).

The rods, or pillars, he described as flattened columns with an anterior and posterior process, the posterior being the one nearer the modiolus, a term he here used for the first time. He called the rods *coins articulaires* where they articulate with each other at their free ends and described *carré-longs*, elongated flattened crowns, mounted upon them at an angle. These structures as we now see them may be observed in my Figures 7, 8, and 9*A*. Corti did not seem to describe a triangular tunnel between the anterior and the posterior branches of the teeth of the second order, although he had previously described a triangular space. It is highly probable that in his many dissections he saw the triangular space (tunnel) but did not succeed in locating it specifically. He spoke of a triangular space when describing the epithelial cells of the internal sulcus. Incidentally, the large round cells which Corti drew to illustrate these cells are not out of proportion when seen in the freshly teased cat preparation. Also, the pillars look exactly as he illustrated them, labeled *ɔ, p, s.*, etc. They float about loose, looking like large-headed pins or even drumsticks, as Corti himself noted. In his Footnote 48 he even suggested that perhaps they beat upon the covering tectorial membrane like little sticks on a drum, in this manner responding to sound.

Corti next described the three cylindrical cells lying beyond the teeth of the second range and fastened to the outer processes of those structures. He saw three such cells in all the mammals he examined, and he saw them mounted in a series of three cells. He described a scape, or *tige*, or stalk, upon which each cylindrical cell was mounted and recognized that their tops were imbricated (Fig. 10*A*). Thus, Corti described what we know as the three outer hair cells. He stated in his Footnote 36 that Huschke had described cones which he had described as cylindrical cells and had thought them to be vibratory cells. Much of Huschke's work was done on various birds, some of which were large in size. The structure corresponding to our "hairs" is single on each cell and looks like a sharp cone in the bird.

Corti's anterior and posterior processes were later spoken of as the outer and inner rods, or arches. My Figure 9*B* shows them as arches covering the triangular tunnel which spirals the length of the cochlea. On the left is a single row of five nuclei of inner hair cells, while on the right are the three rows of nuclei of the outer hair cells. The significance of the constancy of the number three in this organ is not known, nor is the significance of the mathematically rhythmic pattern displayed.

The next subject which Corti discussed was the zona pectinata. He referred to Todd and Bowman's observation of an outer and inner clear band on this structure. He briefly described the mound of cells which we know as Hensen's cells as another group of cylindrical cells consisting of two enlargements enclosing a groove. The mound appeared "a little flattened on each side." The rest of this discussion was devoted to the fibrous(?) nature of the basilar membrane. (The question mark is

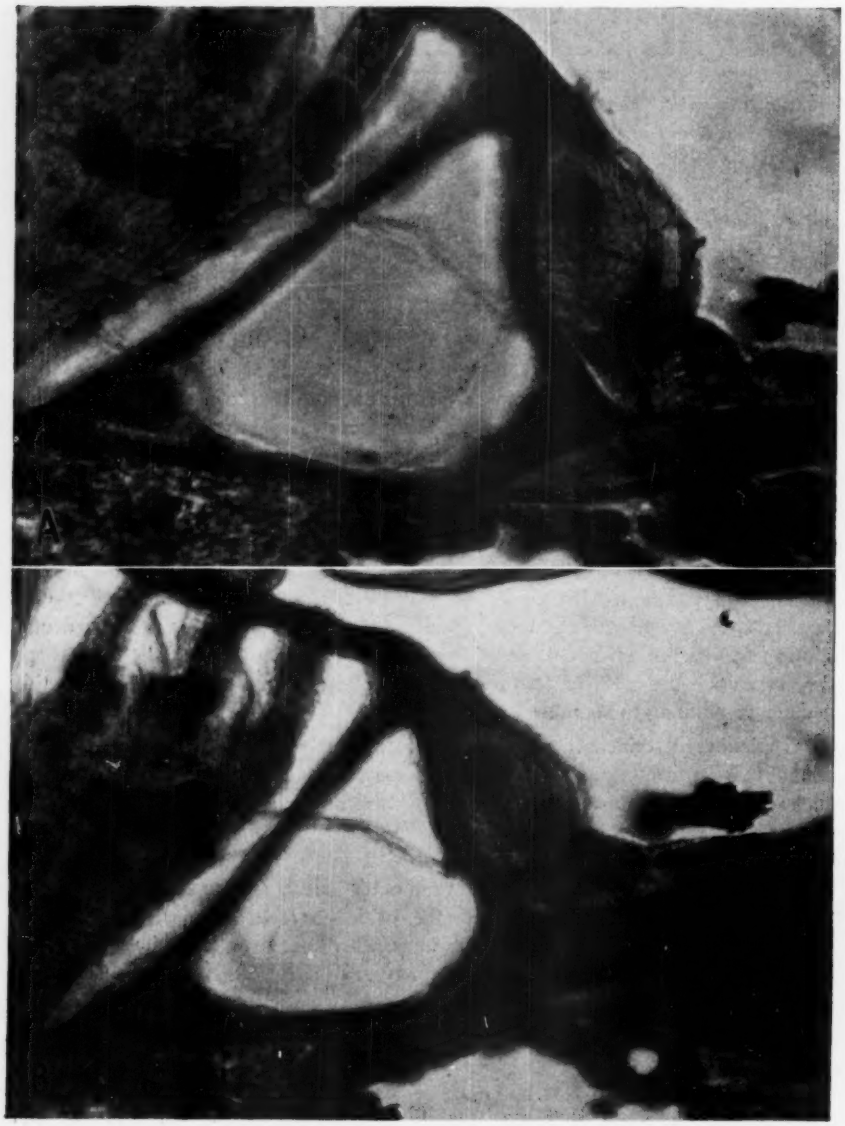

Fig. 7.—*A*, the triangular tunnel formed by the rods of Corti. Note the elongate crown set at an angle, shown better on the outer pillar cell; the inner hair cell with its tuft of hairs, or vibrissae, is seen on the right; beneath it unmyelinated nerve fibers pour across the basilar membrane to a ganglionic net, thence across the tunnel; at lower left three other fibers penetrate the basilar membrane from the tympanic lamina and proceed to Deiters' cells; another strand crosses up to the first net. Monkey. *B*, a deeper focus on section shown in *A*. Here the nerve knot beneath the inner hair cell is apparent; note the fibers crossing the tunnel to the three outer hair cells and also four points of contact on the first Deiters' cell; two phalangeal processes are seen arching over to produce the imbricated surface noted by Corti.

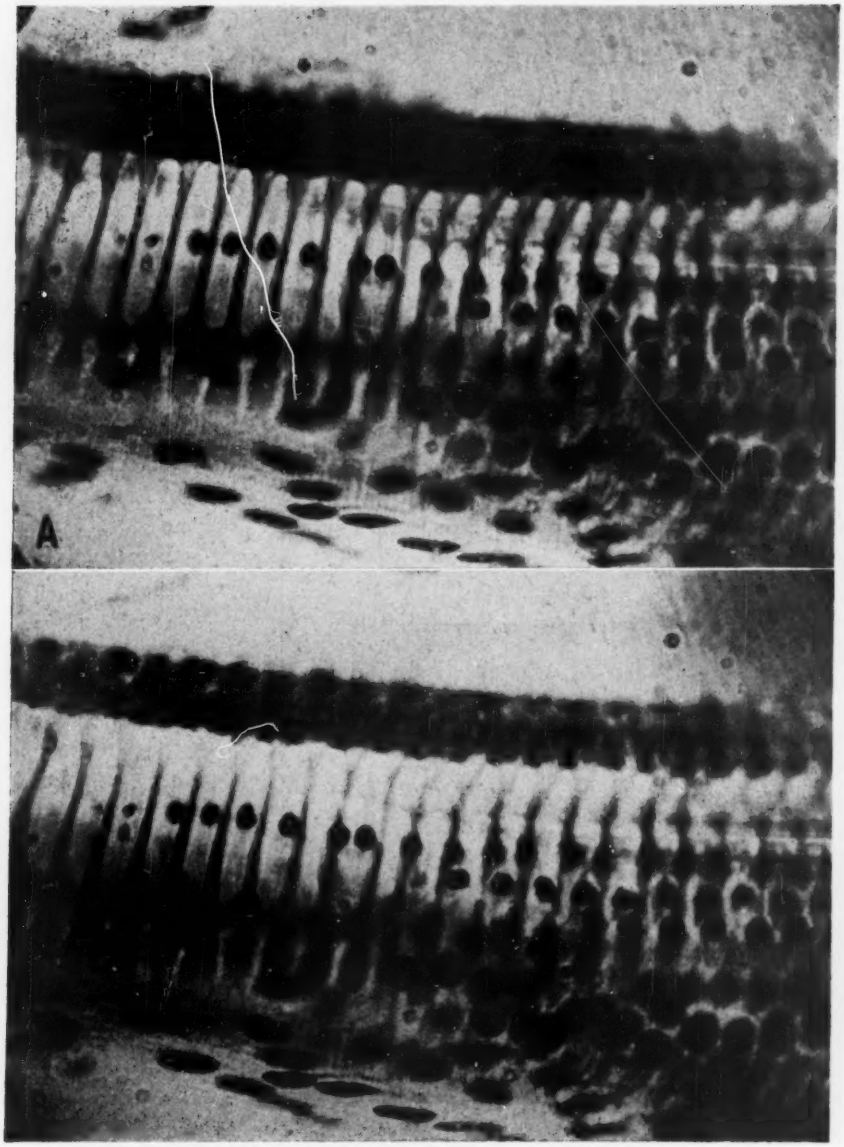

Fig. 8.—*A*, the rhythmic design here seen shows more than a dozen pillars (outer) as they arise, formed by the union of four or five fibers of the basilar membrane; their *coins articulaires* are in the black band above center. Bat 48; sec. 160. *B*, the dark band at the top shows the area of articulation of this row of *coins* with a second row which lies more deeply in the tissue.

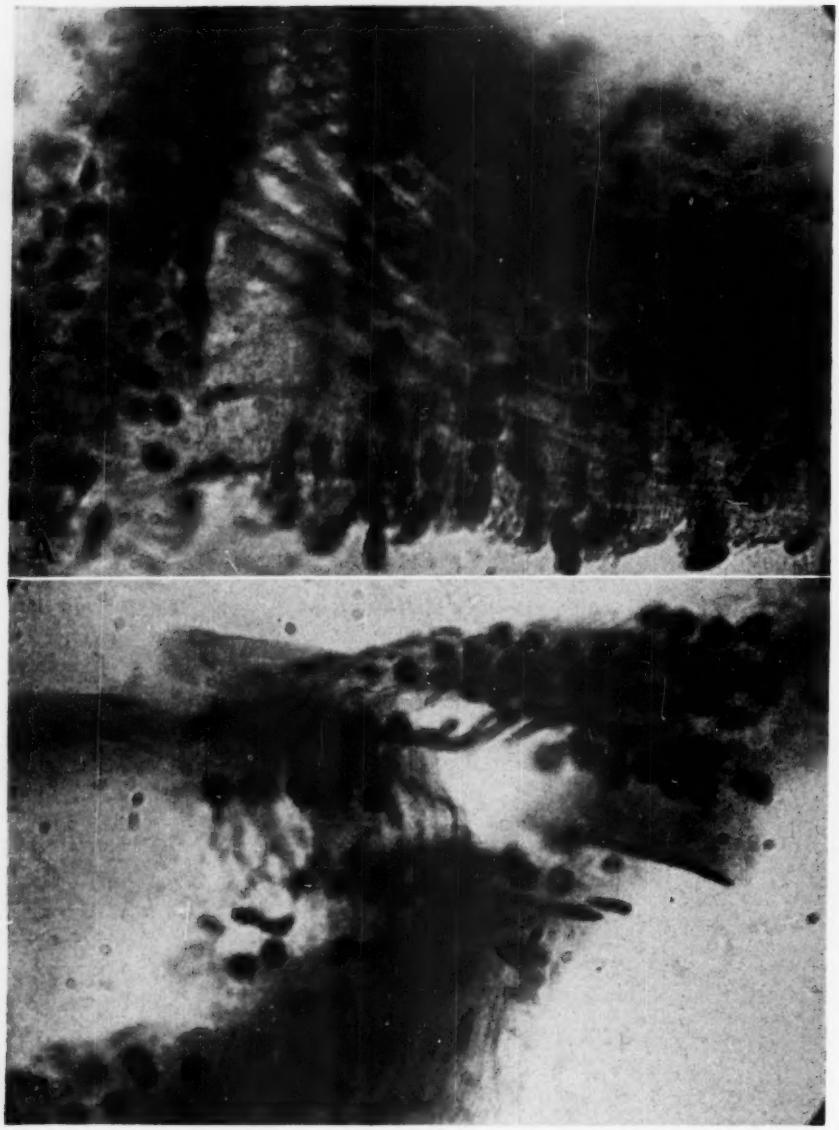

Fig. 9.—*A*, cross sectional view looking down from above on the spiral tunnel. The fibers of the basilar membrane are seen to unite to form the outer pillars; single fibers continue across the basilar membrane to anchor it to the superior lip of the bony spiral lamina; a homogeneous acellular substance fills the intervening spaces. Monkey 63-2; Left sec. 176. *B*, a view looking down on the anterior and posterior processes of the teeth of the second order (Corti), or arches, as Claudius called them. Five nuclei of inner hair cells may be seen to the left of the row of inner pillars and the three ranks of nuclei of the three outer hair cells beyond the outer pillars; note the stiff rod on the floor of the tunnel. Bat 48; sec. 100.

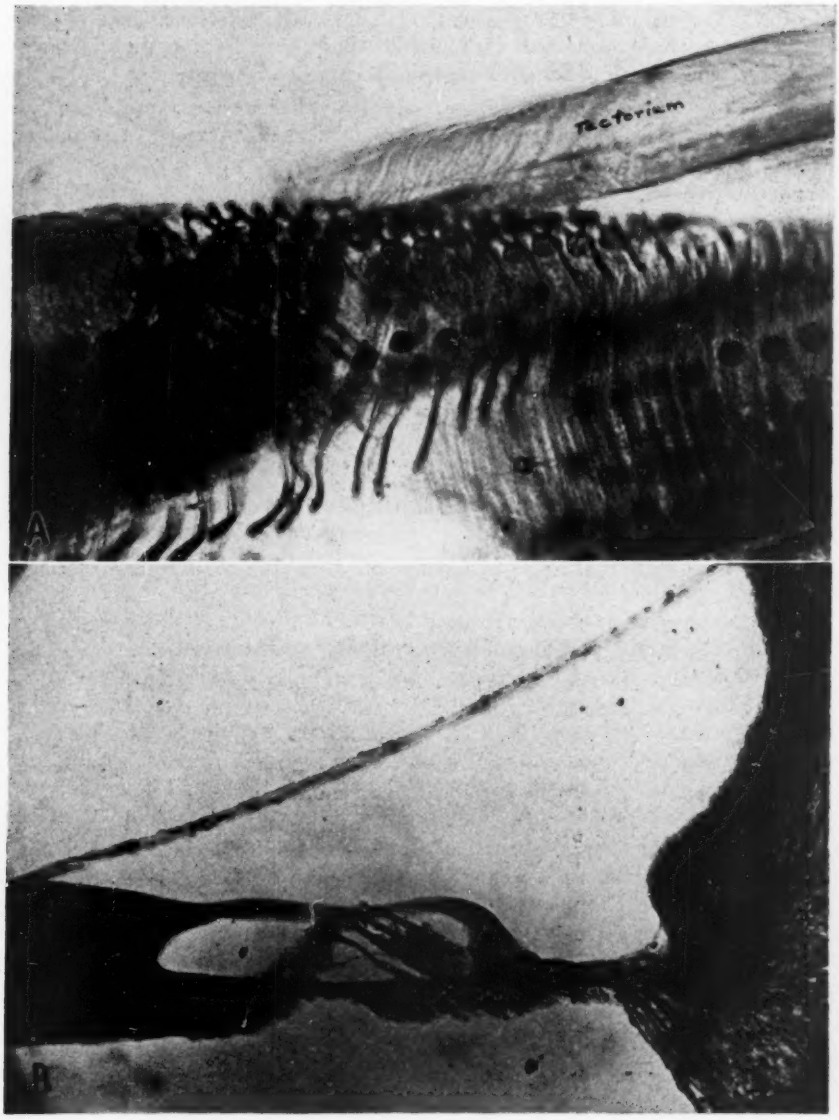

Fig. 10.—*A*, the terminal plates in the cuticular borders of the tops of the cells of the organ of Corti give a "chicken wire" pattern; through these plates the tiny stiff "hairs," or vibrissae, protrude to enter the meshes of the tectorial membrane; Deiters' phalangeal processes are seen angling toward the surface. Monkey 15; Left sec. 147. *B*, a primitive type of nerve net crisscrosses the tunnel; some of these fibers appear to come directly but singly from the spiralling tympanic lamina. Monkey 7; Rt. sec. 209. (Exhibited at the American Medical Association, 1947.)

Corti's insertion). He mentioned in the footnotes that Bendz and Hannover had seen the fibrous nature of this membrane. He obviously understood the origin of the fibers, as we have mentioned. He found it impossible to dislocate the structures on the "vestibular" side of the membrane and keep it intact for study.

The reason for this difficulty becomes apparent when we study my Figures 8 and 9*A* which clearly demonstrate that the outer pillar cells are made of the union of four or five fibers of the basilar membrane. Corti likened the parallel course of these fibers running at right angles to the axis of the cochlea to the strings of a piano (his Footnote 48) and in a subfootnote stated that Hannover had likened them to the strings of a clavicord. No effort was made at this juncture to interpret this observation in terms of physics of sound. Throughout this long footnote Corti discussed the possible physiological functions of the various "teeth" and cylindrical cells he had described and their possible method of transmitting sound vibrations to the nerves beneath them. He thought the number of teeth of the second order (presumably in the cat or the dog) to be about 3,330. The number of cylindrical cells in the human he thought to be about 30,000.

The final distribution of nerve fibers baffled but intrigued Corti. He saw and clearly described the fibers penetrating the basilar membrane beneath the single row of cylindrical cells, the inner hair cells. The apertures, or perforations, through which they passed he described as oval windows, and he knew that beyond this point the fibers were no longer doubly contoured. We would say that they have lost their myelin sheath. This anatomy is illustrated in my Figure 7.

After a somewhat inconsequential comparison of inner ears of various mammals and a brief paragraph on endolymph Corti again returned to a discussion of the nerve supply. He was not sure that all spiral ganglion cells were bipolar, and we are not today. He believed that most of the nerve fibers spiraled in the tympanic lamina and that after they penetrated the basilar membrane they became "lace-like." This is indeed a good simile, as may be seen in my Figures 7, 10*B*, and 11.

Perusal of Corti's work leaves us with a sense of chagrin regarding the anatomists' further contributions through a hundred years. Teasing of fresh and fixed but unimbedded specimens suggests that real rods which look like spun glass and which refuse to take biological dyes, since they are almost crystalline in character, are present. One should note the fine parallel lines in my Figure 8, passing at an angle through the organ. This photograph was obtained by exposing the section to the photographic plate all night. Corti himself frequently remarked concerning the great refraction of light by the component parts of the organ.

The hairs on the hair cells, perhaps better called vibrissae, are undoubtedly much longer and stiffer (more crystalline) in structure than we usually realize. In fixed monkey sections I have found them to increase in length 10 mμ from basal to middle coil and thence to apical. They increase proportionally in width. An average length of hairs of outer hair cells taken at random on the basal turn was 3 mμ; middle turn, 7 mμ; apical turn, 12 mμ (monkey).

I have always felt that by the very nature of things Helmholtz' theory of resonance must be the correct approach to an explanation of the function of the ear. The newer knowledge of physics seems but to fortify it. Modern physicists tell us that the acuity of hearing is so great that the movement of particles involved must be of the order of the size of a hydrogen molecule. In this connection why not consider

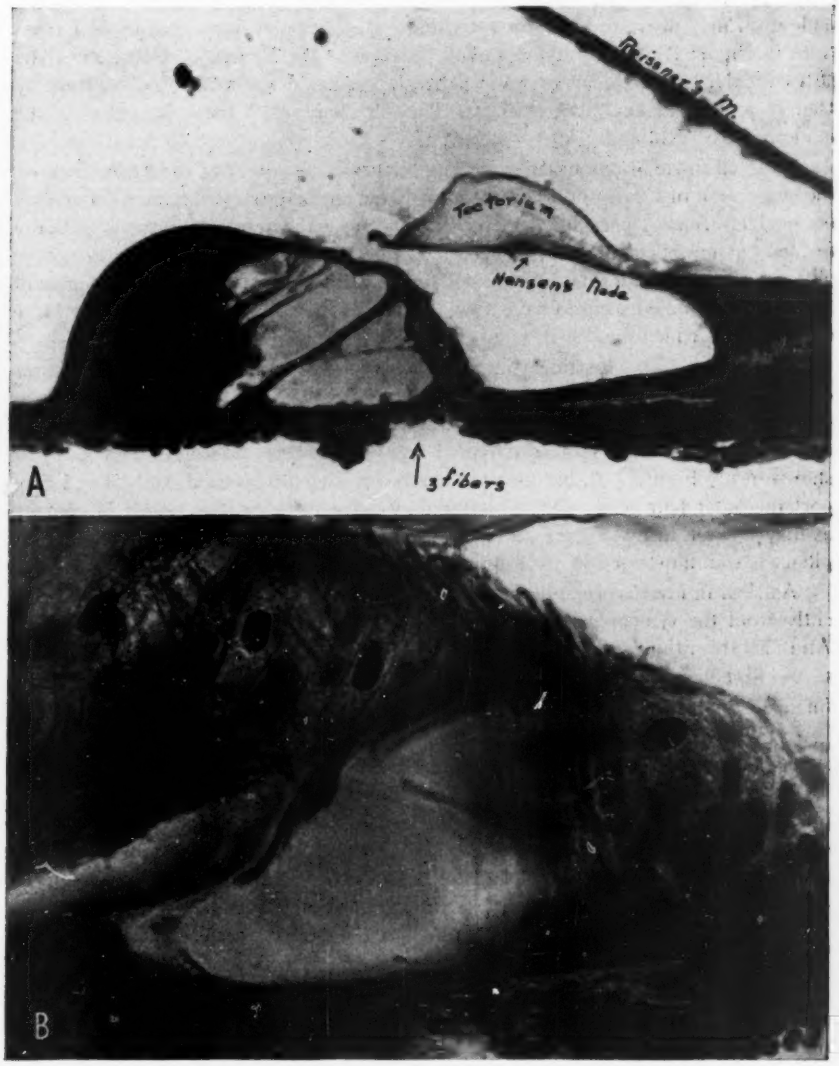

Fig. 11.—*A*, note three fine unmyelinated fibers passing up from the basilar membrane to a nerve knot at the base of inner hair cell, thence crossing the tunnel. Monkey 59; Left 538. *B*, tunnel fibers penetrating between a series of pillars. Note the loose coil as they approach the terminus; the sharp spikes are phalangeal processes; note vibrissae, or "hairs," on the inner and outer hair cells. Monkey.

agitation of tectorial membrane transmitted to enmeshed vibrissae? I believe that the tectorial membrane is attached at the so-called Hensen's node to the inner hair cells, and the outer hair cells are obviously embedded in its interstices. Hensen's node itself may prove to be a stiff spiralling rod. Such structures and those I illustrate in Figure 8 may act like a radio's antennae. My Figure 10*A* illustrates the stiff cuticular surface of the organ of Corti, long since described in the literature by Deiters and Held and his associates. The "chicken wire" mesh suggests to the modern eye a "grating."

If the vibrissae or any other rod-like structures prove to be of crystalline nature, the suggestion of Davis and his associates that a piezoelectric effect may occur may be tenable. Such a possibility one could conceive of in terms of crystals partially formed but never completed, a "slice" of crystal, or liquid crystal. It may not be without significance in this connection that the calcium crystals over the maculae of all mammals studied seem to have a hexagonal shape, a shape similar to those large crystals from which the "slice" is taken for use in radio sets.

My Figure 10*B* illustrates the primitive type of nerve net which crisscrosses the tunnel throughout its length. A set of three fibers comes up to a nerve knot at the base of the inner hair cell, as illustrated in my Figure 11*A*, from which three fibers cross the tunnel to be distributed not only to the three outer hair cells, as shown in my Figure 7 *B*, but also to Deiters', or the sustenacular, cells which support the outer hair cells. On the latter they make three or four points of contact, as may be seen in my Figure 7. The penetration of these nerve fibers between the pillars is well illustrated in my Figure 11 *B*.

As seen in my Figure 7*A*, nerve fibers, again three in number, also pass apparently from the tympanic lamina across the tympanic membrane to Deiters' cells. And also from this lamina a fiber penetrates the basilar membrane and passes back to the first nerve knot at the base of the inner hair cell. If one focuses back and forth on thick sections through the tunnel, one gets the impression of a series of ganglionic chains. The specific, as well as the diffuse, nerve distribution here presented, as well as the spiralling collaterals described by Ramón y Cajal, Held, Lorente de Nó, and Fernandez, would seem to provide anatomic structures for physiological effects recorded by modern investigators (Wever and his associates) of localized and diffuse reception of stimuli. It may also explain the possibility of some degree of hearing in the presence of marked degeneration of organ of Corti cells, as in Day's recent case and in a series reported by Bunch and me.[6]

The possibility of the tympanic lamina consisting of nerve fibers was considered by Corti. Damage of it on exposure to excessively loud sounds, as produced by Lurie, points toward this possibility.

The meaning of the "magic" number three in the anatomy of this organ is as yet obscure. If it occurred only in man, we might think that musical harmony based on thirds had some relationship, since we are told by musicologists that primitive tribes give their calls and chants on such a basis. But they also use the intervals of the fifth and seventh. Furthermore, the series of threes occurs in all rodents.

This grouping in threes in the human spiral ganglion was noted by me not only for the rows of ganglion cells but also for the number of fibers traveling in parallel

6. Bunch, C. C., and Wolff, D.: The Absence of Organ of Corti: An Audiometric and Histologic Study, Ann. Otol. Rhin. & Laryng. **44**:736 (Sept.) 1935.

and approaching a ganglion cell.[7] The question which Corti put remains unanswered. "Are all these cells bipolar?" The impression is certainly registered, as one studies the spiral ganglion cells, that some cells receive three afferent processes and send cranially one process. Rasmussen has shown that not all fibers stop at the spiral ganglion cells.

The function of Hensen's cells remains obscure. They seem to be particularly susceptible to distortion when chloroform is used to anesthetize the animal. Nor has the last word been said in regard to the mode of action of tectorial membrane. In unpublished work done by me with H. Frings on exposure of mice to very high-pitched and intense sounds (supersonic to man but not to mice) the tectorial membrane appears to have been thrown into violent activity. In some instances it was obviously in the act of sweeping the organ of Corti off from the basilar membrane. The end-effect of the organ dislodged from the basilar membrane was noted by Lurie.

Thus, one hundred years after the first careful description of the organ of Corti, now coming to be called the spiral organ, there remain many problems regarding the organ of hearing. These await the "prepared mind."

7. Wolff, D.: The Ganglion Spirale Cochleae, Am. J. Anat. **60**:55-77 (Nov.) 1936.

PALPATION OF STAPES FOR FIXATION

Preliminary Procedure to Determine Fenestration Suitability in Otosclerosis

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ONE CANNOT determine with absolute certainty if the stapes is completely fixed by any method except palpation of it with a probe during the fenestration operation. Pure-tone and speech audiometry tests have increased knowledge and predictability as to the result to be expected following fenestration for otosclerosis. The knowledge gained from these tests, however, is inferential and therefore limited as regards the degree of stapedial fixation present (partial or complete). Palpating the stapes to and fro, however, gives direct, firsthand sensory experience because one can see and feel the degree of mobility or its complete fixation. Such direct experimental knowledge is more reliable than the inferential diagnosis obtained by audiometry tests.

A completely fixed stapes is pathognomonic of an otosclerosis condition which is ideal for treatment by fenestration, provided always that good cochlear nerve function is present. A partially fixed stapes in otosclerosis may not be as ideal for treatment by fenestration. The fenestration operation should therefore be performed on patients with completely fixed stapes to insure the best results. The purpose of this preliminary report is to describe a simple method of palpation of the stapes which can determine partial or complete fixation.

METHOD

The method consists of exposing the stapes at the incudostapedial junction. This is done through a speculum in the external auditory canal, the operator wearing the Zeiss binocular loupe used in the fenestration operation. The lower half of the eardrum is lifted out of its sulcus and folded upward upon itself in a manner described in the operation on the chorda tympani nerve for Ménière's disease.[1]

Two hours before operation the patient is given 3 grains (0.2 gm.) of pentobarbital (nembutal®) sodium, and one hour before operation he is given 100 mg. of meperidine (demerol®) hydrochloride. One-half cubic centimeter of 1% procaine hydrochloride with a few drops of epinephrine is injected subcutaneously at the posterosuperior junction of the external auditory canal at its beginning externally. An incision is made through the skin over the bony canal wall from 3 to 9 o'clock about 6 to 7 mm. external to the drum. The skin is separated from the bone as far as the drum, and the drum is then lifted out of its sulcus and reflected upward upon itself to give an apron-like appearance. In over 85% of the cases the incudostapedial

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1. Rosen, S.: Surgery in Ménière's Disease: A New Operation Which Preserves the Labyrinth: Report of Cases, Ann. Otol. Rhin. & Laryng. **60**:657 (Sept.) 1951.

junction comes into view at once; in the rest the very edge of the posterior bony canal just external to the incus for 3 to 6 mm. is removed from the front backwards. This procedure exposes the long process of the incus, the incudostapedial junction, the head and crura of the stapes, sometimes the foot-plate of the stapes, the tendon of the stapedius muscle, the chorda tympani nerve, and a portion of the incudomalleal articulation. The long process of the incus close to its articulation with the stapes is moved gently downward with a probe for a distance of a fraction of a millimeter. In the presence of a partially fixed stapes the incus, the head and crura of the stapes, and the stapedius tendon will all be seen and felt to move together. When gentle pressure, forward and backward, of the probe is exerted similarly

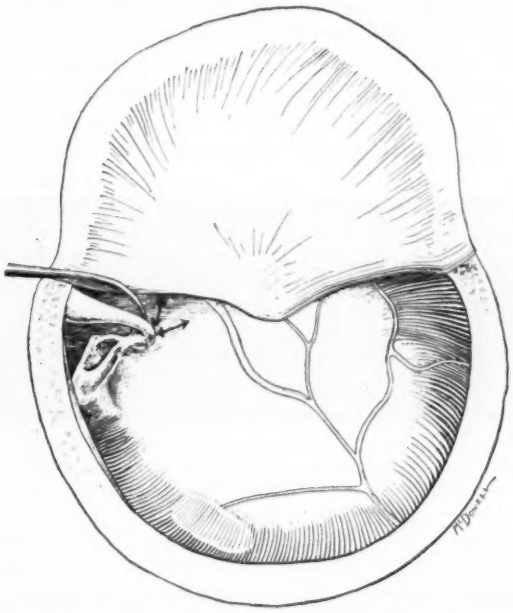

Fig. 1.—The drum is reflected upward, and the long process of the incus and the head, neck, crura, and tendon of the stapes are seen. The palpating probe is placed against the long process of the incus close to the stapes. The slight up-and-down pressure against the incus is made in the direction of the upper arrow. When the stapes is only partially fixed, the incus and the head, neck, crura, and tendon of the stapes are all seen to move together. Slight pressure of the point of the probe on the head and neck of the stapes is exerted in the direction of the lower arrow. When the stapes is only partially fixed, the head and crura can be seen to move. In a completely fixed stapes no movement whatever is seen of the head, neck, crura, or tendon of the stapes.

against the neck or on the head of a partially fixed stapes, the latter can be seen and felt to move. In a completely fixed stapes absolutely no movement of the head and crura occurs (Fig. 1).

When the foot-plate of the stapes is completely and rigidly fixed, palpation with the greatest pressure does not cause any movement of the head or crura whatever. This condition was demonstrated artificially by imbedding foot-plates in Wilsedge optician cement after removing the stapes from 50 fresh cadavers. This procedure rendered the foot-plate completely rigid and fixed. In every one of these stapes

great pressure on the head and neck produced no motion, although there was great variation in the structure of the stapes and in the thickness of the crura (Fig. 2). When the stapes was partially fixed, the exertion of much less pressure resulted in such movement of the head, crura, and tendon as could be seen and felt. Use of very slight pressure against the stapes in the normal ear resulted in maximum movement. These results were verified both in the cadaver and in the living patient during the operation of section of the chorda tympani for Ménière's disease. Any movement of the head and neck of the stapes indicates movement of the foot-plate.

The to-and-fro movement of a partially fixed stapes could loosen the foot-plate even more. This increased mobility of the foot-plate could result in proportionately increased hearing, because normal hearing depends on the most freely moving stapes. It is conceivable that in patients treated by this method more hearing could be regained than is possible to achieve by fenestration, because the intact ossicular chain which is necessary for normal hearing is preserved (Case 5 in next section). Interruption of the continuity of the ossicular chain by the necessary removal of the incus in the fenestration operation is a constant factor in the lowering of the possible

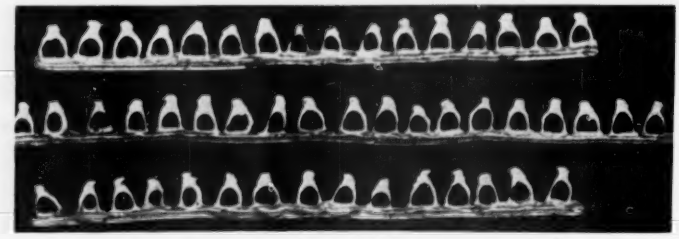

Fig. 2.—Fifty stapes removed from fresh cadavers, with the foot-plates completely fixed in cement. Despite the wide variation in structure and thickness of the crura, firm pressure on the head and neck produce no motion whatever of crura or foot-plate.

hearing improvement by 20 to 30 db. in all patients. After palpation is completed, the drum and the skin of the canal wall are returned to their normal positions. The patient is ambulatory on the day of operation and may leave the hospital the following day. The patients involved in the following illustrative cases were operated on by the above method as an exploratory diagnostic procedure to determine complete or partial fixation of the stapes. The observations in Case 5 are striking.

REPORT OF CASES

Case 1.—E. S., a 30-year-old woman with one child, had bilateral progressive deafness and tinnitus for 15 years. There was no family history of deafness. In September, 1951, the left drum was elevated. There were no adhesions around the ossicles or elsewhere. The incus close to its junction with the stapes was moved up and down. There was no movement of the stapes whatever, and firm pressure against the head and neck of the stapes in all directions resulted in none. The stapes was rigid and completely fixed. On this patient fenestration will be done (Fig. 3 *A*).

Case 2.—S. L., a man 38 years old, had constant tinnitus in his left ear for five years and bilateral progressive deafness for four years. There was no family history of deafness. In October, 1951, the left drum was raised and the stapes palpated as described. No movement of the stapes could be induced in any direction. The stapes was rigid and completely fixed. No other pathologic condition was present. Fenestration will be done (Fig. 3 *B*).

CASE 3.—S. S., a man 51 years old, had bilateral progressive deafness for 15 years prior to examination. There was no family history of deafness. In January, 1952, the left eardrum was raised. No movement of the stapes could be induced. The stapes was rigid and completely fixed. Fenestration will be done (Fig. 3*C*).

CASE 4.—N. V., a 22-year-old man, had bilateral progressive deafness for four to five years prior to examination and tinnitus in both ears for as long as he could remember. His father and 24-year-old sister are hard of hearing. In March, 1952, the right drum was lifted out of its sulcus and folded upward as described. When the stapes was palpated, it could be seen to move, although its motion was limited. Fenestration should not be done at this time (Fig. 3*D*).

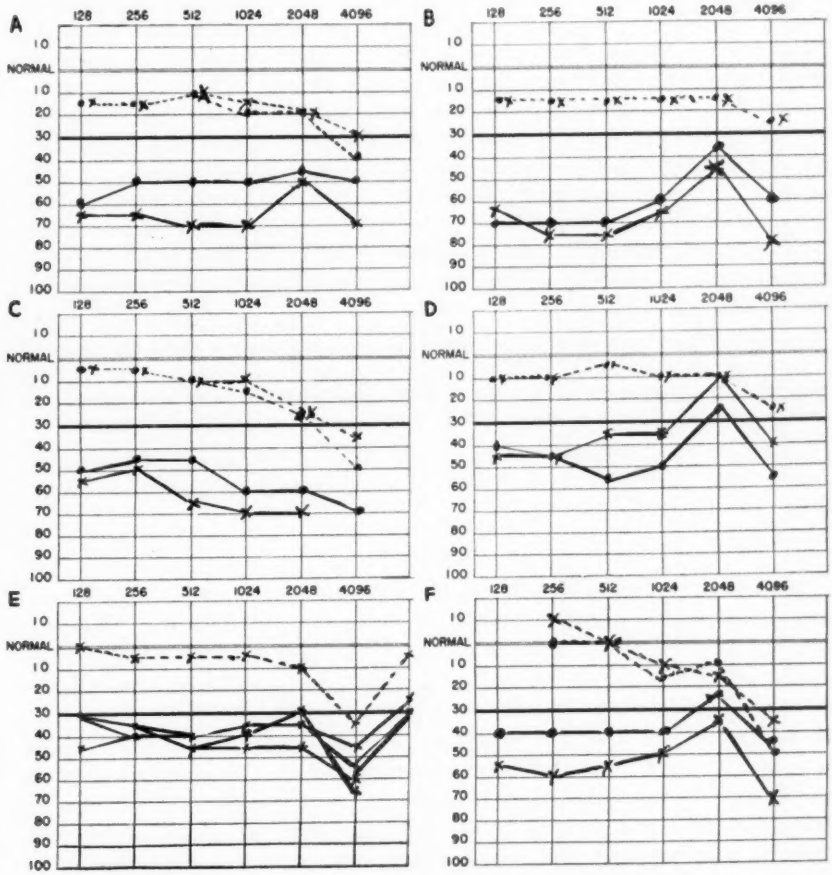

Fig. 3.—Audiograms made in six cases of bilateral progressive deafness. *A*, Case 1 (E. S.), *B*, Case 2 (S. L.), and *C*, Case 3 (S. S.): The stapes is fixed completely; fenestration is to be done. *D*, Case 4 (N. V.): The stapes is fixed partially; fenestration is to be postponed. *E*, Case 5 (E. L.): The solid-line air-conduction audiograms shown were taken of the patient's left ear by various examiners over a four-year period preceding palpation of the stapes; the dash-line air-conduction audiogram shown was taken 2½ weeks following palpation; an audiogram (not shown) taken 1½ weeks following palpation showed an average pure-tone loss of 15 db. by air; the speech reception threshold for this ear was 40 db. as recorded 1 week prior to palpation and 10 db. as recorded 2½ weeks following palpation. *F*, Case 6 (C. G.): The stapes is fixed partially; fenestration is to be postponed.

Symbols used are the following: heavy black dot, right ear; cross mark, left ear; dash line, bone; solid line, air.

CASE 5.—E. L., a married man 43 years old, had bilateral progressive deafness, much more marked in his left ear. His mother and maternal grandmother have been deaf for a great many years. He had high-pitched tinnitus at times. He had been observed by outstanding otologists in various parts of the country, all of whom strongly suspected otosclerosis as the cause of his deafness and leaned toward fenestration as the method of treatment. He was referred to me for fenestration. The decision reached by the patient and myself was to lift up the left eardrum to test for stapes fixation. On April 3, 1952, this procedure was done. On palpation the stapes was partially fixed but could be seen to move. Suddenly during the to-and-fro movement of the stapes the patient said, "I can hear everything now—things I haven't heard for so many years" (Fig. 3*E*).

This phenomenon was identical with the sudden return of the hearing of patients while on the operating table at the completion of the artificial fenestra in cases of otosclerosis. The hearing improvement in this case has persisted and increased to date. Possibly the partially fixed foot-plate of the stapes was loosened and made more movable, resulting in this remarkable improvement in hearing. Slight increase in the mobility of the foot-plate could result in marked improvement in hearing, since all the conditions of normal hearing which nature has provided are in this procedure maintained—a movable foot-plate in nature's own oval window and an intact ossicular chain. This condition, it seems, would have advantages over the complex physical, mechanical, and physiological changes introduced by the fenestration operation, i. e., an artificial window, a change in acoustics, and an interruption of the ossicular chain function.

CASE 6.—C. G., a 28-year-old man, had bilateral progressive deafness of two years' duration. His mother is hard of hearing. In April, 1952, both eardrums were lifted up in order to palpate the stapes. The stapes was movable on both sides. Fenestration should not be done at this time (Fig. 3*F*).

The progress of these patients will be reported later. Perhaps these findings will stimulate others to test for stapes fixation in order to select the patients with conditions most suitable for fenestration.

COMMENT

Palpation of the stapes could be useful in determining in which cases of otosclerosis fenestration should or should not be done. This is a most desirable determination to be able to make if fenestration surgery is to reach its greatest potential of success. When the stapes is found completely fixed, fenestration may be performed soon afterward. When the stapes is found partially fixed, the fenestration operation should be postponed. To-and-fro palpation of the partially fixed stapes may render the foot-plate even more mobile. This increased mobility could restore hearing via the normal ossicular chain and nature's own oval window, a window superior in all respects to any man-made one. The procedure described may be done and even repeated on one or both ears, possibly, in the beginning, in those cases in which the corrected air-bone gap [2] is 45 db. or less in the speech frequencies. In still doubtful cases it would seem profitable first to employ this procedure, because crucial knowledge may thus be gained, especially in cases in which the fenestration on one side has been unsuccessful. If adhesions, etc., are

2. Shambaugh, G. E., and Carhart, R.: Contributions of Audiology to Fenestration Surgery, Including a Formula for the Precise Prediction of the Hearing Result, A. M. A. Arch. Otolaryng. **54**:699 (Dec.) 1951.

present instead of otosclerosis, they can be dealt with and an unnecessary fenestration avoided. The degree of pressure and the amount of to-and-fro motion exerted against the stapes and incus must be learned on the cadaver. It may be that fenestration surgery can now be employed in those cases of complete stapes fixation which can be predetermined with certainty. If the partially fixed foot-plate of the stapes can be rendered more mobile (as it seems to have been in Case 5) by the to-and-fro palpation, it may be the simplest and most efficient way to restore hearing in large numbers of cases of otosclerosis.

SUMMARY

A simple procedure of palpation of the stapes is described for determining the degree of fixation of the stapes, partial or complete, as a test of fenestration suitability.

Manipulation of the partially fixed stapes could result in further mobility of the foot-plate, with improved hearing.

In the procedure described conduction deafness due to adhesions, etc., could be dealt with instead of the surgeon performing a fruitless fenestration operation.

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CRICOPHARYNGEAL MUSCLE UNDER NORMAL AND PATHOLOGICAL CONDITIONS

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THE STUDIES of Templeton and Kredel [1] and my own studies [2] have proved that the two portions of the inferior constrictor muscle of the pharynx respond in different manners when the pressure in the hypopharynx is increased during Valsalva's experiment. The oblique portion of the muscle yields to the pressure from within and becomes more or less distended, while the circular portion, viz., the cricopharyngeal sphincter, responds with a spastic contraction. This observation is in agreement with the finding of Killian [3] who has proved that even the strongest pull exerted on the larynx cannot achieve an opening of the cricopharyngeal sphincter. It is possible to pull the closed sphincter together with the larynx forward, but it is not possible to open the sphincter. This finding is likewise noticed in Figure 1, which shows an extreme displacement of the larynx due to Valsalva's experiment in a man 65 years old who complained of slight dysphagia; he had to eat and, particularly, to drink slowly and cautiously; otherwise, he would choke. Despite the extreme enlargement of the hypopharynx, the cricopharyngeal sphincter is closed tightly.

Contrary to the oblique portion, the cricopharyngeal muscle responds to increased air pressure with a spastic contraction, which is evident in the roentgenogram, because the posterior wall at the junction of the pharynx and the esophagus becomes thicker (according to Templeton and Kredel,[1] the thickening may increase to approximately 1 cm. in depth and 1 cm. in width) and forms a "cross roll" at the posterior wall which I have called the "hypopharyngeal bar" and which has been analogized with Passavant's bar [4] in the epipharynx.[5] The hypopharyngeal bar

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1. Templeton, F. E., and Kredel, R. A.: The Cricopharyngeal Sphincter—Roentgenologic Study, Laryngoscope **53**:1, 1943.

2. Brunner, H.: X-Ray Examination of the Cricopharyngeal Sphincter, "Hypopharyngeal Bar," J. Laryng. & Otol. **66**:276, 1952.

3. Killian, G.: Ueber den Mund der Speiseröhre, Ztschr. Ohrenhlk. **55**:1, 1908.

4. Passavant, P. G.: Ueber die Verschliessung des Schlundes beim Sprechen, Frankfort on the Main, Germany, J. D. Sauerländer, 1863.

5. Killian [3] has analogized a fold of the pharyngeal mucosa which he calls "the lip of the mouth of the esophagus" to Passavant's bar. However, there is no analogy between these structures, as (a) the hypopharyngeal bar is formed by a muscle, while "the lip of the mouth of esophagus" is formed by a submucous venous plexus, and (b) Passavant's bar serves to shut off the epipharynx, while "the lip" is noticeable when the cricopharyngeal sphincter relaxes, creating a free passage between pharynx and esophagus. Naturally, "the lip" has nothing to do with what is called "hypopharyngeal bar" in this paper.

caused by Valsalva's experiment is not elicited by a reflex contraction of the cricopharyngeal muscle due to the detachment of the larynx from the posterior pharyngeal wall but by the increased air pressure in the pharynx. This conclusion is drawn from the following findings: 1. Under pathological conditions a hypopharyngeal bar may be noticed without displacement of the larynx ("spontaneous hypopharyngeal bar"). This observation is discussed later in this paper. 2. Templeton and Kredel [1] noticed the formation of a slight hypopharyngeal bar during esophageal speech in patients who had had a laryngectomy, a finding which I confirmed. Therefore it can be stated that the hypopharyngeal bar is primarily, though not exclusively, caused by the increased air pressure in the pharynx (or eventually in the cervical esophagus).

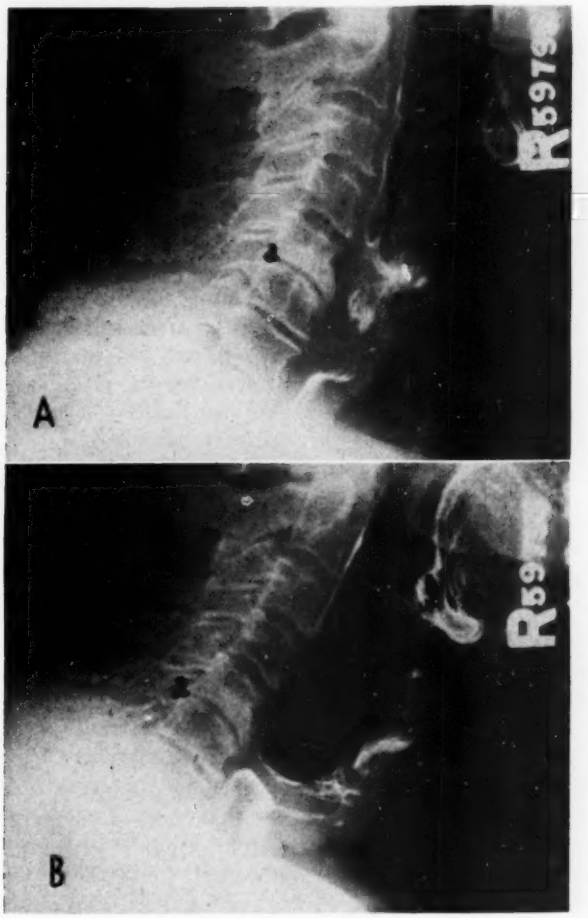

Fig. 1.—*A*, spondylitis of the cervical vertebrae (*a*) which causes a spontaneous hypopharyngeal bar. *B*, the same area during Valsalva's experiment; note the very considerable displacement of the larynx and of the cricopharyngeal sphincter, the latter being tightly closed.

Owing to the hypopharyngeal bar, the lumen at the junction of the pharynx and the esophagus bulges markedly toward the trachea. The bulging may show different degrees. There is a moderate degree (Type I) and an excessive degree (Type II). The boundaries between these degrees are, of course, not sharply defined. Templeton and Kredel [1] believe that the hypopharyngeal bar becomes more bulging as Valsalva's experiment is more vigorously performed. In other words, the size of the bulging is proportionate to the pressure in the hypopharynx. This finding does not agree with my experience. There are instances in which Valsalva's experiment is vigorously performed; yet there is a hypopharyngeal bar of only moderate degree, and vice versa. Moreover, during normal deglutition the pressure in the hypopharynx is likewise increased; yet the muscle does not respond with a spastic contraction but with relaxation. These findings indicate that the hypopharyngeal bar per se is well caused by increased pressure in the hypopharynx, but the size of the hypopharyngeal bar is not exclusively dependent on mechanical factors. It seems that the cricopharyngeal sphincter has an elective activity which is controlled by (unknown) biological factors. In other words, the hypopharyngeal bar per se, as well as the size of the hypopharyngeal bar, is dependent on both the pressure in the hypopharynx and the excitability of the cricopharyngeal muscle.

The hypopharyngeal bar is visible as long as the spastic contraction of the muscle persists. In Valsalva's experiment the spastic contraction persists only as long as the pressure in the hypopharynx is increased. For this reason the hypopharyngeal bar caused by Valsalva's experiment is a transitory phenomenon.

TRANSITORY HYPOPHARYNGEAL BAR

For the clinical evaluation of the hypopharyngeal bar the following criteria must be set up: 1. Valsalva's experiment must be properly performed. This can be checked by the displacement of the larynx as seen in the roentgenogram. 2. The cervical vertebrae must be normal. The lumen of the cricopharyngeal sphincter frequently bulges in normals toward the uppermost portion of the trachea without Valsalva's experiment being performed. This bulging, however, is invariably slight, unless the lordosis of the cervical vertebrae is exaggerated or there are arthritic exostoses of the cervical vertebrae (Fig. 1). In these instances the bulging is more prominent; viz., there is a slight hypopharyngeal bar, and there may even be dysphagia. Recently Piquet [6] again emphasized that the dysphagia in these cases is not mechanical in origin because (*a*) the difficulty is not proportionate to the size of the exostoses, (*b*) the difficulty is acute, while the arthritis is a chronic disease, and (*c*) the patients complain of pain and not of an obstacle in the throat. Piquet [6] believes that the pain in the throat is caused by chronic edema of the connective tissue which surrounds the roots of the spinal nerves. In my opinion, the pain in swallowing may be caused by a reflex spasm of the cricopharyngeal sphincter due to spondylitis. This idea is suggested by the finding of a hypopharyngeal bar in these instances.

If the Valsalva experiment is properly performed and the cervical vertebrae are normal, the size of the hypopharyngeal bar permits approximate conclusions to be drawn concerning the excitability of the cricopharyngeal muscle. There is hypo-

6. Piquet, J.: Les troubles pharyngo-laryngés par spondylite déformante de la colonne cervicale, Ann. oto-laryng. **68**:697, 1951.

excitability of the muscle if the bar is very slight or absent, normal excitability if the bar is moderately bulging (Type I), and hyperexcitability if the bar is very marked (Type II). These terms are, of course, not exact, but they serve a clinical purpose, particularly if they are based on frequent examinations.

Hypoexcitability of the Cricopharyngeal Muscle.—This finding was obtained in the study of cases of injury to the neck. Two cases of this type were examined.

CASE 1.—The patient suffered a gunshot lesion of the neck, in 1945, which caused a permanent aphonia. He complained of occasional difficulty in breathing. When he ate solid food, pieces entered the larynx, causing coughing spells. Examination on Dec. 28, 1948, revealed a normal larynx as far as the mucosa and the vocal cords were concerned. Below the anterior commissure there was a newly formed membrane with a crescent-like margin which extended into the subglottic space and caused a narrowing of the lumen. The roentgenogram showed a considerable retention of barium sulfate suspension in the valleculae and in the pyriform sinuses. Valsalva's maneuver gave rise to the formation of a very slight hypopharyngeal bar.

CASE 2.—The patient had been in an automobile accident on Sept. 16, 1944, when he was 18 years old. There were several lacerations of the neck and face. An operation had to be performed immediately after the injury, and the entire second cartilaginous ring of the trachea had to be removed. A low tracheotomy was performed. Subsequent to the operation a fusiform constriction of the trachea developed at the level of the first and second thoracic vertebrae to about one half of the normal caliber, and there was recurrent laryngeal nerve paralysis on the left side. He was voiceless for four months. On Feb. 25, 1949, he complained of difficulty in breathing and in swallowing. Food stuck at the level of the sternum. Examination revealed several scars on the neck, with formation of tender keloids. The left vocal cord was fixed in the paramedian position, and the abduction of the right vocal cord was slightly restricted. X-ray examination showed that at the level of the seventh cervical vertebra there was a soft tissue shadow which had the shape of a triangle, the base of the triangle was at the posterior wall of the trachea, and the tip extended into the lumen of the trachea. This was apparently a hypertrophic scar. Transillumination showed a hold-up of the barium in the esophagus immediately above the sternum. Several roentgenograms showed that there was no retention of barium in the valleculae and the hypopharynx but that there was a small traction diverticulum of the hypopharynx apparently caused by traction of the scar in the posterior wall of the trachea. Valsalva's maneuver caused only a very slight hypopharyngeal bar (Fig. 2).

In both instances Valsalva's experiment failed to cause a hypopharyngeal bar of normal size. The reason is likely an injury to the cricopharyngeal muscle which resulted in a diminution of the contractibility of the muscle.

The findings in unilateral recurrent laryngeal nerve paralysis are interesting. Four cases have been examined. In one case paralysis on the right side was caused by bronchogenic carcinoma; in the second case paralysis on the left side was caused by a tumor in the neck; in the third case paralysis on the right side was caused by a shrapnel injury to the skull (Fig. 3), and in the fourth case paralysis on the right side was caused by thrombosis of the posteroinferior cerebellar artery. In all cases Valsalva's experiment resulted in the formation of a moderate hypopharyngeal bar (Type I); only in the case of advanced bronchogenic carcinoma was the bar slight. These findings prove that unilateral recurrent laryngeal nerve paralysis usually does not interfere with the contractibility of the cricopharyngeal muscle; in some cases it may cause hypoexcitability of the muscle.[7]

7. Teschendorf (Teschendorf, W.: Die Röntgenuntersuchung der Speiseröhre, Ergebn. med. Strahlenforsch. **3**:175, 1928) noticed in two cases of bulbar paralysis a dilatation of the hypopharynx and a retention of barium in the hypopharynx and in the upper cervical esophagus; yet there was no dilatation in the area of the cricopharyngeal muscle.

These findings may indicate that in unilateral recurrent laryngeal nerve paralysis there is no difficulty in swallowing. This conclusion, however, is not confirmed by practical experience. In three of the four cases there was difficulty in swallowing, subjective as well as objective. In a fifth case (Fig. 4) in which the patient was suffering from recurrent laryngeal nerve paralysis on the right side there was likewise swallowing difficulty, subjective as well as objective. The patients complained

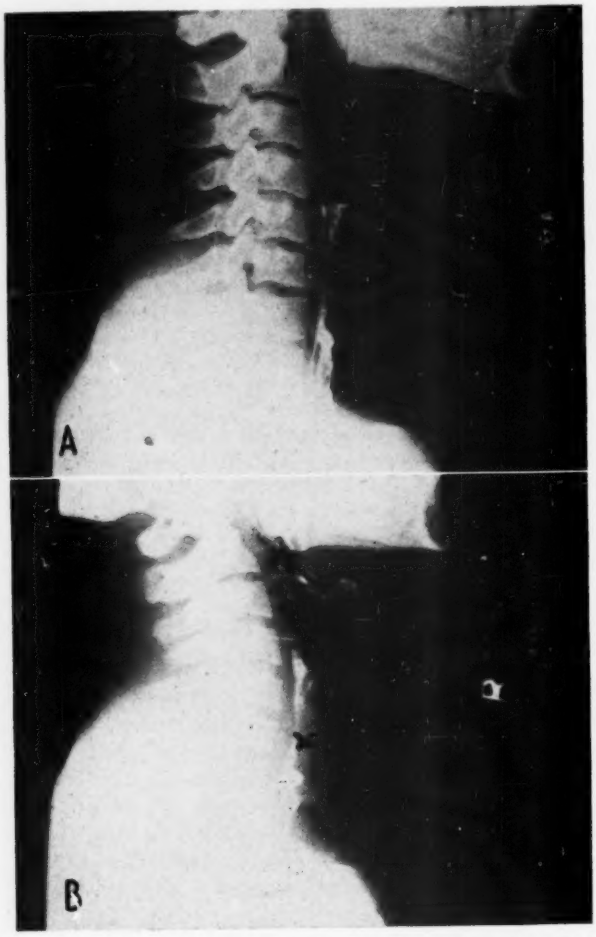

Fig. 2.—*A*, cervical esophagus following ingestion of barium; note small traction diverticulum and small triangular soft tissue shadow projecting anteriorly into trachea opposite lower border of seventh cervical vertebra; there is no hypopharyngeal bar. *B*, same area during Valsalva's maneuver; note small hypopharyngeal bar (*x*).

that solid food stuck in the throat, while fluids passed into the esophagus. This condition is not in agreement with the findings of Asherson [8] who claims that in unilateral recurrent laryngeal paralysis the dysphagia is usually latent. The dis-

8. Asherson, N.: Achalasia of the Cricopharyngeal Sphincter: A Record of Cases, with Profile Pharyngograms, J. Laryng. & Otol. **64**:747, 1950.

crepancy is probably caused by the additional diseases associated with the recurrent laryngeal paralysis in my cases. In one case there was narrowing of the hypopharynx due to exostosis of the cervical vertebrae; in another case there was bronchogenic carcinoma; in the third case there was paralysis of several cranial nerves, and in the fourth case there was severe involvement of the medulla oblongata and of the cerebellum. These additional findings may explain the manifest dysphagia in these instances.

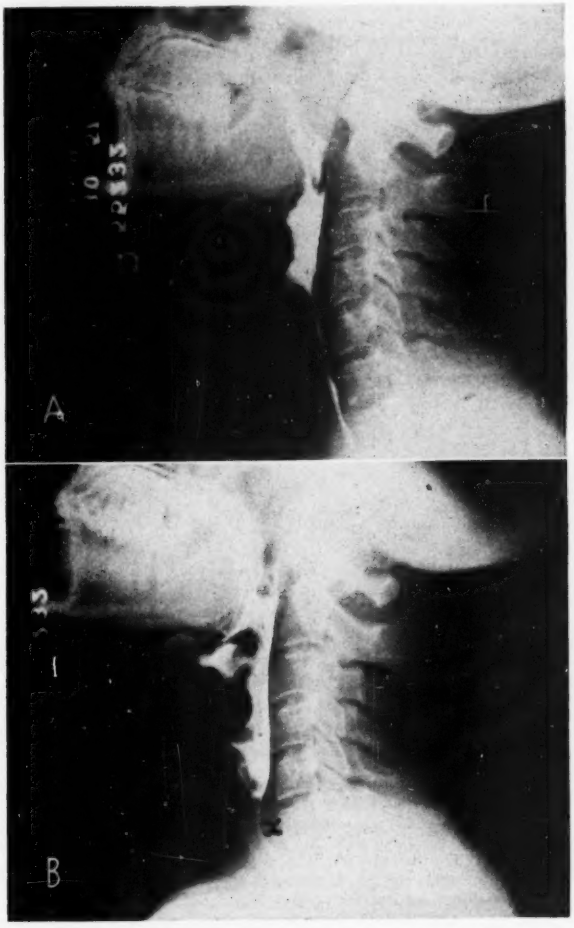

Fig. 3.—This patient suffered a shrapnel injury to the skull in 1944. The shrapnel piece entered in the right temporal area and came to rest in the upper third of the neck. Immediately after the injury there was traumatic exophthalmos, pounding and deafness in the right ear, inability to swallow, and loss of voice. On Oct. 30, 1951, he complained that he could not eat solid food without washing it down. Drinking was not disturbed. There was exophthalmos and miosis on the right side. There was paralysis of the right hypoglossal nerve and of the right sympathetic nerve, accumulation of saliva in the right pyriform sinus, and paralysis of the right recurrent laryngeal nerve, the vocal cord being in the paramedian position. *A*, note the massive retention of barium in the hypopharynx. *B*, massive retention of barium in the hypopharynx; hypopharyngeal bar (*x*) during Valsalva's experiment.

The complaints of dysphagia in these cases were verified by the x-ray findings, which revealed a massive retention of barium in the pharynx in four of the five cases. The retention was likewise noticed by Asherson,[8] who apparently believes that unilateral recurrent laryngeal nerve paralysis causes achalasia of the cricopharyngeal sphincter which, in turn, is the cause of the retention in the pharynx. I am not prepared to confirm or refute this concept because the finding of a hypopharyngeal bar gives information about the contractibility of the muscle but not about its ability to relax. However, it must be realized that retention of barium

Fig. 4.—A white man, aged 70, suffered from arthritis for many years. In addition, he complained of breathing difficulty and, since July, 1941, of swallowing difficulty. In December, 1942, a recurrent laryngeal nerve paralysis on the right side was discovered. Several esophagoscopies were performed, and the following findings were obtained: There appeared to be some deviation of the esophagus lumen in the region of the cervical esophagus. It deviated sharply to the right immediately behind the larynx and then resumed a midline position. This may be due to a compression from outside on the esophagus, on the left side. X-ray examination revealed a fusion of sixth and seventh cervical vertebrae, which accounts for the atrophy of the right sternocleidomastoid and omohyoid muscles and for the difficulties in the right shoulder. There is a massive retention of barium in the hypopharynx, part of which overflows into the larynx. Valsalva's experiment was not performed (*x*—spondylitis).

in the hypopharynx is not necessarily caused by achalasia of the sphincter; it can be likewise due to paralysis of the concerted action of the levators and constrictors of the pharynx which fail to propel the bolus toward the sphincter (Montandon [9]).

9. Montandon, A.: Pseudo-spasme permanent de la bouche de l'œsophage et myoporphyrie (le syndrome d'occlusion myopathique du sphincter crico-pharyngien), Pract. oto-rhino-laryng. **10**:267, 1948.

At present, it cannot be stated which mechanism is responsible for the retention in unilateral recurrent laryngeal nerve paralysis.

In the two cases of injury to the neck there were likewise complaints of dysphagia. In one case the patient complained that pieces of solid food entered the larynx, causing a coughing spell. In this case Valsalva's experiment produced only a negligible hypopharyngeal bar. One would have expected that in this case the barium would freely pass the hypoexcitable sphincter; yet there was considerable retention in the valleculae and in the pyriform sinuses. At present, no explanation of this finding can be offered. In the second case the patient complained that food stuck at the level of the sternum. This condition was caused by a small traction diverticulum (Fig. 2) in the hypopharynx and by the stricture of the esophagus.

Hyperexcitability of the Cricopharyngeal Muscle.—In this instance the hypopharyngeal bar caused by Valsalva's experiment is very marked. Type II is frequently encountered. This finding has been obtained in "functional disorders of the pharynx." I am aware of the vagueness of this terminology. However, the term "functional disorders of the pharynx" does not denote an exact diagnosis but only the absence of an organic lesion for a long period. Other laryngologists use the terms "upper dysphagia" (Paterson [10]), "secondary vallecular dysphagia," "dysphagia atonica" (Holzknecht and Olbert [11]), and "pseudospasm of the mouth of the esophagus."

Six of my cases belong to this group. In all these cases there was formation of a hypopharyngeal bar of excessive size (Type II, Fig. 5). In all cases there were complaints of dysphagia, which in one case persisted for eight years. The dysphagia was not permanent and did not seriously interfere with the nourishment of the patient. The following symptoms were noticed: Solid food entered the larynx, causing a coughing spell or a choking sensation or vomiting; there was no difficulty in swallowing solid food, but the patient had to swallow twice or more to get fluids down; solid food stuck in the throat; there was regurgitation of solid food or fluids, particularly of cold fluids. In three cases a considerable retention of barium in the valleculae and in the hypopharynx was noticed. In one case administration of atropine and in another inhalation of amyl nitrite achieved improvement.

A seventh case may be added because of its clinical interest.

A 60-year-old man complained of periodical dysphagia for a long period. There was no difficulty in the swallowing of solid food, but, when he drank, he occasionally had the feeling of a foreign body in the throat and had to swallow two or three times to get the fluid into the esophagus. This difficulty was followed by pain which extended into the chest. There was no regurgitation. At examination the patient was underweight, the pharynx and larynx were normal, and the roentgenogram revealed signs of an old pleuritic condition in the chest.

The diagnosis "functional disorder of the pharynx" was made because the dysphagia persisted for a long period and no organic lesion was discovered in the pharynx and esophagus. A marked hypopharyngeal bar was expected in Valsalva's experiment. However, the contrary finding was obtained; there was practically no retention of barium in the pharynx, and the hypopharyngeal bar was not prominent. This unexpected finding was caused by changes of the cervical spine. There was an alteration of the contour of the cervical spine, with a slight posterior displacement of the body of the fifth cervical vertebra, producing pseudokyphosis at the level of the fifth

10. Paterson, D. R.: Upper Dysphagia, J. Laryng. & Otol. **52**:75, 1937.

11. Holzknecht, G., and Olbert, D. D.: Die Atonie der Speiseröhre (Dysphagia atonica; Pseudo-oesophagismus), Ztschr. klin. Med. **71**:91, 1910.

and sixth cervical vertebrae. There was a narrowing of the cervical intervertebral space at the fifth and sixth spaces, and there was hypertrophic osteoarthritis of the cervical spine. The cervical esophagus was apparently pulled posteriorly, owing to the posterior displacement of the cervical vertebra, and thus the formation of a marked hypopharyngeal bar was inhibited (Fig. 6).

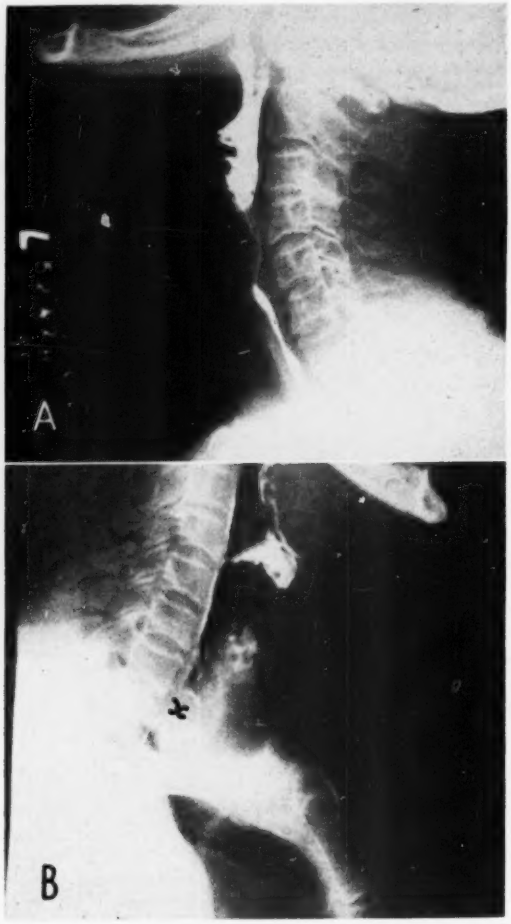

Fig. 5.—A white man, aged 73, complained of an obstacle in the throat for the swallowing of solid food. There was no difficulty in drinking. There were 3,600,000 erthrocytes and 8,000 leucocytes in the blood, and the hemoglobin was 70%. No pathological condition was seen in the pharynx and larynx except an accumulation of some saliva in the right pyriform sinus. *A*, massive retention of barium in the pharynx and a slight hypopharyngeal bar. *B*, a hypopharyngeal bar of Type II during Valsalva's experiment. The patient was observed for a period of several months. He was given vitamins.

In summary, in instances of functional disorders of the pharynx characteristic symptoms were noticed: (1) complaints of moderate and periodical dysphagia; (2) retention of barium in approximately 50% of the cases, and (3) formation of a very prominent hypopharyngeal bar. The prominence of the hypopharyngeal bar

has been explained by hyperexcitability of the cricopharyngeal muscle. The dysphagia in these instances is problematical. An excessive hypopharyngeal bar in Valsalva's experiment is not necessarily associated with dysphagia. There must be another, additional, cause which, at present, is not known. Considering the slight anemia which was discovered in some of these cases, one could theorize that the etiology of the dysphagia may be related to Plummer-Vinson's syndrome (Kelly [12]

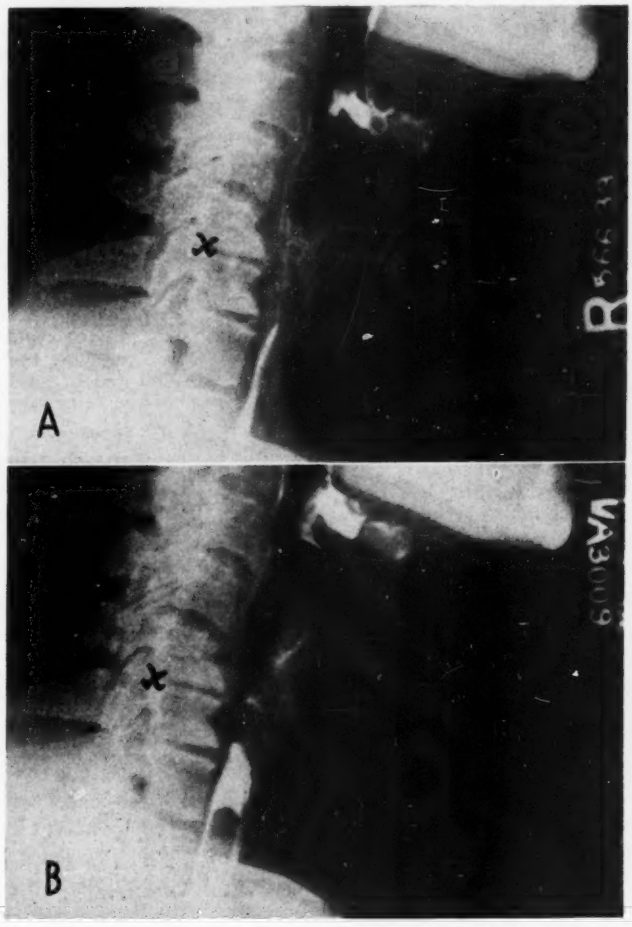

Fig. 6.—*A*, slight pseudokyphosis in the cervical vertebrae (*x*). *B*, roentgenogram taken during Valsalva's experiment; there is only a slight hypopharyngeal bar due to the kyphosis of the cervical vertebrae.

and Gerlings [13]). In some of the other cases web formations at the mouth of the esophagus may have been the cause. In one of the cases esophagoscopy was performed, and no pathological condition was discovered.

12. Kelly, A. B.: Nervous Affections of the Oesophagus, J. Laryng. & Otol. **42**:221, 1927.
13. Gerlings, P. G.: Disorders of the Mouth of the Œsophagus in the Syndrome of Plummer-Vinson (Dysphagia with Anæmia), J. Laryng. & Otol. **55**:143, 1940.

Likewise problematical is the retention of barium in the pharynx in approximately 50% of the cases. An excessive hypopharyngeal bar does not cause retention because an excessive hypopharyngeal bar may be and usually is associated with a normal opening of the sphincter during the act of swallowing. At present an explanation cannot be offered. However, the retention of barium in functional disorders of the pharynx is interesting from another point of view; von Pannewitz [14] and Arendt and Wolf [15] claim that retention of barium in the pharynx indicates an organic disease of severe prognosis. Arendt and Wolf [15] noticed retention of barium in instances of carcinoma of the cardia of the hypopharynx and of the esophagus, mediastinal tumors, carcinoma of the lungs close to the main bronchi, bulbar paralysis, and myasthenia gravis and in instances of abnormal origin of the right subclavian artery (dysphagia lusoria). The symptom of retention of barium may precede the clinical symptoms of tumor for a considerable period. In neurotics complaining of dysphagia Arendt and Wolf [15] did not notice retention of barium.

Asherson [8] claims that retention of barium in the hypopharynx is caused by achalasia of the cricopharyngeal sphincter, viz., by a partial or complete failure of, as well as a delay in, the relaxation of the cricopharyngeal sphincter. In these instances barium may stagnate in the dilated and elongated hypopharynx and may remain in situ up to 54 minutes. Achalasia of the cricopharyngeal sphincter is supposed to be the result of a broken reflex arc.

I am not in agreement with either concept. Certainly the retention of barium in the hypopharynx may eventually precede the clinical symptoms of tumor of the cardia, hypopharynx, lungs, or other organs. But barium retention, though not of excessive degree, may likewise occur in patients who do not show signs of a malignant lesion in a period of several years. Retention of barium is likewise not necessarily caused by achalasia of the sphincter. It was mentioned before that, from the theoretical point of view, it may be caused eventually by a failure of the oblique fibers of the inferior constrictor muscle to perform a vigorous contraction.

SPONTANEOUS, OR PERMANENT, HYPOPHARYNGEAL BAR

In the preceding section the transitory hypopharyngeal bar, viz., the hypopharyngeal bar caused by Valsalva's experiment, was discussed. Under certain pathological conditions, however, a bulging at the posterior wall can be noticed at the junction of the pharynx and the esophagus, although Valsalva's experiment is not performed by the patient. This bulging has the same appearance and lies exactly at the same place as a hypopharyngeal bar of moderate degree caused by Valsalva's experiment, and it is not produced by changes of the vertebrae. For this reason it is a spontaneous, or permanent, hypopharyngeal bar. Since the transitory hypopharyngeal bar is due to a spastic contraction of the cricopharyngeal muscle, it is a fair conclusion that the spontaneous, or permanent, hypopharyngeal bar is caused by a permanent spasm of the cricopharyngeal muscle.

The present view is that permanent spasms of the cricopharyngeal muscle do exist, that they occur infrequently, and that they eventually may terminate fatally.

14. von Pannewitz, G.: Partielle Schlucklähmung als Röntgensymptom bei Erkrankungen des Oesophagus, Fortschr. Geb. Röntgenstrahlen **44**:170, 1931.

15. Arendt, J., and Wolf, A.: The Vallecular Sign: Its Diagnosis and Clinical Significance, Am. J. Roentgenol. **57**:435, 1947.

Stierlin [16] reported two cases, one of a woman aged 64 years who had difficulty in swallowing for 14 days and another of a man aged 36 years who had been troubled with dysphagia for six months. In both cases, at autopsy, the mucosa of the esophagus was normal, but a prominent muscle bundle was noticed encircling the upper end of the esophagus at the level of the lower border of the cricoid plate, causing an obstruction of the esophagus. In the second case the lumen of the hypopharynx above the encircling muscle bundle was dilated, simulating a diverticulum. This, in fact, was the diagnosis made during the life of the patient.

The same type of case was reported by Montandon [17] under the heading "L'occlusion permanente passive ou myopathique du sphincter supérieur." The syndrome consists of (*a*) progressive and finally total dysphagia without discernible cause, (*b*) a hold-up of barium at the level of the mouth of the esophagus, (*c*) a failure of the cricopharyngeal muscle to relax, and (*d*) cachexia and general malaise, prior to the dysphagia, which is not associated with a lesion of the central or peripheral nervous system. The esophagoscopic examination reveals simple achalasia of the sphincter in the absence of a mechanical obstruction, a lesion of the mucosa, or spastic stenosis "avec forte saillie du bourrelet de Killian." Microscopically, Montandon noticed a marked degenerative atrophy of the upper segment of the esophagus which affected the muscular layer, particularly the fibers of the cricopharyngeal muscle. The neuroganglionic apparatus was only slightly involved. The cause was myoporphyrism in two instances and vascular sclerosis in the third case. In this group also belongs, probably, a case observed by me.

A white man aged 58 years had lost 40 lb. in four years and complained of loss of strength and of dysphagia and hoarseness which had been present for about six to eight months. There was little pain on swallowing, but he noted a feeling of mucus collecting in the throat and had been unable to swallow fruits, meat, or vegetables for six months prior to hospitalization. He could only drink milk and eat butter. He could not recall the specific time of onset of the dysphagia.

At examination the skin had a bronze color. There was general tenderness and atrophy of the skeletal muscles. There were signs of avitaminosis, particularly of vitamin B and ascorbic acid. Knee and Achilles reflexes were absent, but there were no other neurological symptoms. The x-ray findings in the lungs were suggestive of hilar tuberculosis. Sputum examination gave negative results. The Mantoux test gave positive results. On Nov. 17, 1939, x-ray examination of the pharynx and esophagus with the use of a barium meal showed a narrowing of the lumen of the upper esophagus, which is consistent with a malignant condition. However, a reexamination at a later date revealed only temporary retention in the valleculae, with no obstruction in the esophagus. Esophagoscopy on Nov. 21, 1939, showed no constriction, but there was redundant mucosa just below the cricopharyngeal sphincter. A biopsy was done and was reported as showing slightly hyperplastic stratified squamous epithelium, very nearly normal. He died on Dec. 11, 1939. The autopsy revealed pulmonary tuberculosis, caseous tuberculosis of the adrenals, and Addison's disease. Examination of the esophagus and pharynx showed absence of the normal longitudinal mucosal folds but otherwise no significant pathological findings. Microscopic examination of the inferior constrictor muscle and the external muscles of the larynx did not reveal any definite pathological condition.

Montandon [17] distinguishes between genuine spasms and "false spasms" of the upper esophagus. Genuine spasms are intermittent parakinetic symptoms, most frequently of reflex origin. It is likely that the transitory hypopharyngeal bar

16. Stierlin, E.: Zur Klinik und Pathologie des Oesophagospasmus, Jahresk. ärztl. Fortbild. 9:3, 1918.

17. Montandon, A.: Les spasmes permanents de la bouche de l'œsophage, in Proceedings of the Fourth International Congress of Otolaryngology, London, 1949, Vol. 2, p. 893.

caused by Valsalva's experiment is due to a genuine spasm of the cricopharyngeal muscle. False spasms are progressive and permanent and are caused by a latent organic lesion of the sphincter. The cases of Stierlin,[16] Montandon,[17] and me belong to this group. The conditions were probably all caused by pathological changes of the cricopharyngeal muscle, although there is microscopic evidence only in the cases of Montandon.[17] The pathological changes break the normal reflex arc which relaxes the sphincter to allow the passage of food into the esophagus. Unfortunately, the hypopharyngeal bar was not examined in these instances.

The cases of Stierlin,[16] Montandon,[17] and me present the false spasm of the cricopharyngeal muscle in an extreme degree. Cases of this type are exceptional. It seems, however, that cases of false spasm of the sphincter of moderate degree are encountered more frequently. Negus [18] refers to foreign bodies, neoplasms, acute and chronic inflammations, or ulcerations in the hypopharynx as causing spasm of the cricopharyngeal sphincter. Negus has apparently noticed this finding in esophagoscopic examinations. I have made essentially the same observation by means of x-ray examinations of the hypopharynx. In seven cases a permanent hypopharyngeal bar was noticed, indicating a false spasm of the cricopharyngeal sphincter. In five of these cases there was a pathological condition of the pharynx.[19]

CASE 1.—A man had two operations, in 1942, for a pharyngeal diverticulum. In 1951 there was no dysphagia. Nevertheless, x-ray examination revealed a massive retention of barium in the pyriform sinuses and in the remnant of the diverticulum. Below the diverticulum there was a spontaneous hypopharyngeal bar (Type I).

CASE 2.—A 32-year-old schizophrenic white man complained of difficulty in swallowing for a period of six or seven weeks. In the last days he had, in addition, difficulty in breathing. There was a large swelling of the posterior wall of the pharynx, particularly on the left side, extending into the hypopharynx. A prophylactic mediastinotomy was performed, and a large retropharyngeal abscess was drained. Recovery ensued. The roentgenogram (Fig. 7) shows the large retropharyngeal abscess, the retention of barium in the hypopharynx, and the permanent hypopharyngeal bar (*x*). No roentgenogram was taken after the operation.

CASE 3.—A white man suffered from carcinoma at the base of the tongue. The roentgenogram (Fig. 8) shows retention of barium in the hypopharynx and a permanent hypopharyngeal bar (*x*).

CASE 4.—A 68-year-old Negro man complained of difficulty in swallowing. When he ate solid food, he had to swallow several times to squeeze the bolus into the esophagus. There was no pain, no regurgitation, and no loss of weight, but there were low back aches. X-ray examination revealed osteoarthritis of the vertebrae. In addition, an area of increased radiolucency was discovered overlying the left acetabular fossa, which may have represented either a cystic lesion or, possibly, a metastasis. On Nov. 21, 1950, the posterior portion of the vocal cords was normal. There were granulations at the laryngeal surface of the epiglottis resulting in a thickness of the left side of the epiglottis. The left pyriform sinus was slightly narrowed. The petiolus and the anterior portion of the vocal cords could not be visualized. Penicillin and soft diet were given. The difficulty in swallowing diminished, but the findings in the larynx remained unchanged. X-ray examination (Fig. 9 *A*) revealed a massive retention in the pharynx and a permanent hypopharyngeal bar (*x*). In addition, there was a deep ulceration at the base of the epiglottis. The barium covered the laryngeal surface of the epiglottis but did not enter

18. Negus, V. E.: The Mechanism of Swallowing, J. Laryng. & Otol. **58**:48, 1943; The Second Stage of Swallowing, Acta oto-laryng. Supp. 78, p. 78, 1949.

19. Schatzki (Schatzki, R.: Reliefstudien an der normalen und krankhaft veränderten Speiseröhre, Acta radiol., 1933, Supp. 18, p. 1) presents a roentgenogram in a case of bronchial carcinoma. The picture (Fig. 5 *B*) shows a spontaneous hypopharyngeal bar.

the ulceration of the epiglottis (because it was filled with granulations) and trickled into the larynx. A laryngectomy was performed in another hospital. The surgical specimen showed a marked narrowing of the opening of the larynx. When the specimen was opened from behind, there was an extensive overgrowth and infiltration of the structures of the larynx, extending upward toward the epiglottis, of fairly rubbery, grayish, whitish, and yellowish tumor tissue. There was moderate edema of the vocal cords and marked infiltration of both the true and the false cords by tumor tissue. Microscopically, there was epidermoid carcinoma, grade three. A roentgenogram taken after the operation shows that the spontaneous hypopharyngeal bar is absent (Fig. 9 *B*).

Fig. 7.—Note the retention of barium in the hypopharynx, the retropharyngeal abscess (*a*), and the spontaneous hypopharyngeal bar (*x*).

CASE 5.—A white man 57 years old suffered from an old syphilitic condition and carcinoma of the tongue, with large metastases in the lymph nodes of the neck. The roentgenogram showed a spontaneous hypopharyngeal bar which was markedly increased during Valsalva's experiment. There was, in addition, retention of barium in the valleculae and in the hypopharynx, some barium in the larynx, and tracheomalacia.

In all these cases there was a pathological condition in the pharynx or close to the pharynx and a spontaneous hypopharyngeal bar. In addition, there was massive retention of barium, and in four of the five cases there was manifest dysphagia. Whether the retention was caused by hypoactivity of the oblique fibers of the inferior constrictor or achalasia of the cricopharyngeal sphincter is a more theo-

retical question. It is certain that a spontaneous hypopharyngeal bar is associated with massive retention of barium in the pharynx which occasionally may reach such a degree as to cause an overflow of barium into the larynx. This relationship, however, should not be interpreted as the permanent hypopharyngeal bar being the cause of the retention, since in unilateral laryngeal recurrent nerve paralysis there is likewise a retention in the pharynx but there is no spontaneous hypopharyngeal bar. The spontaneous hypopharyngeal bar is not necessarily associated with manifest dysphagia, and Valsalva's experiment may cause a more or less marked increase of the spontaneous hypopharyngeal bar.

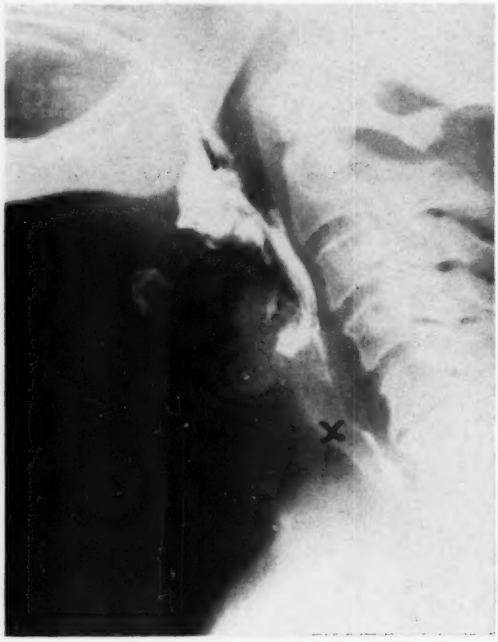

Fig. 8.—Note the retention of barium in the hypopharynx and the spontaneous hypopharyngeal bar (*x*).

It may be theorized that in these cases the permanent hypopharyngeal bar has the purpose of protecting the lower digestive tract from the pathological products of the disease in the pharynx. In instances of pharyngeal diverticulum the spontaneous bar may be produced by the increased pressure in the hypopharynx above the cricopharyngeal sphincter. The underlying cause of the permanent hypopharyngeal bar is not known. It is likely that in some of these instances microscopic changes similar to those reported by Montandon [20] may be responsible. The finding of a permanent hypopharyngeal bar in carcinoma of the hypopharynx has a particular practical interest because it proves that the tumor has not involved the cricopharyngeal sphincter.

20. Montandon.[9,17]

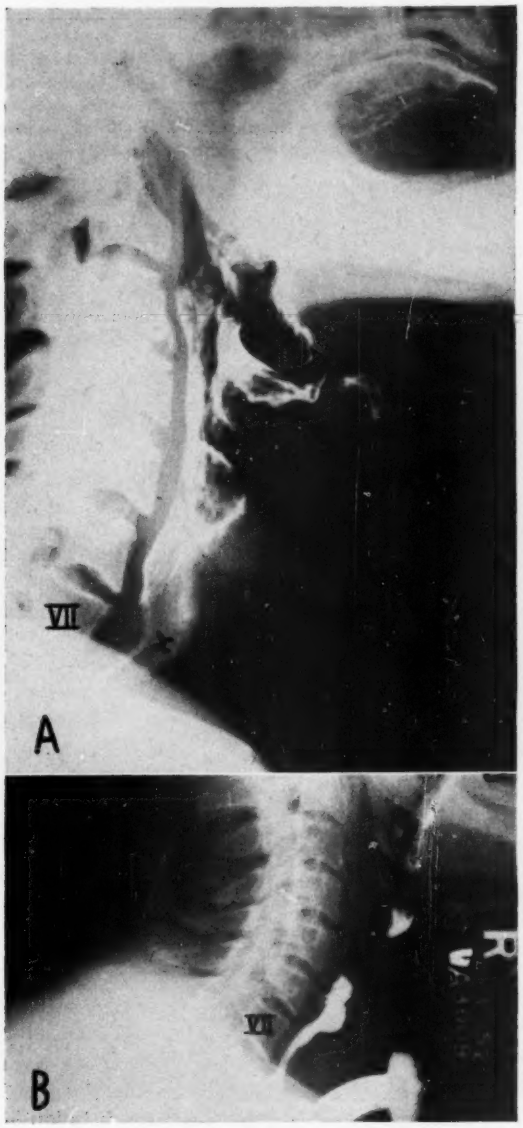

Fig. 9.—*A*, roentgenogram taken before the laryngectomy; *x*—spontaneous hypopharyngeal bar; VII—seventh cervical vertebra; the arrows indicate the ulceration at the base of the epiglottis. *B*, roentgenogram taken after the operation; there is no spontaneous hypopharyngeal bar.

In contrast to these findings, I have observed two cases in which a permanent hypopharyngeal bar of moderate degree was noticeable; yet there was no organic pathological condition in the pharynx or in the cervical vertebrae.

CASE 1.—A 44-year-old white man complained of hoarseness for a long period. He did not complain of difficulty in swallowing. He had been nervous and had had temper tantrums since childhood. The psychiatric diagnosis was psychoneurosis, conversion reaction, and alcoholism. No pathological condition in the larynx and pharynx had been noticed in a period of three years, but he used the ventricular-band voice; viz., he approximated the false cords to produce his

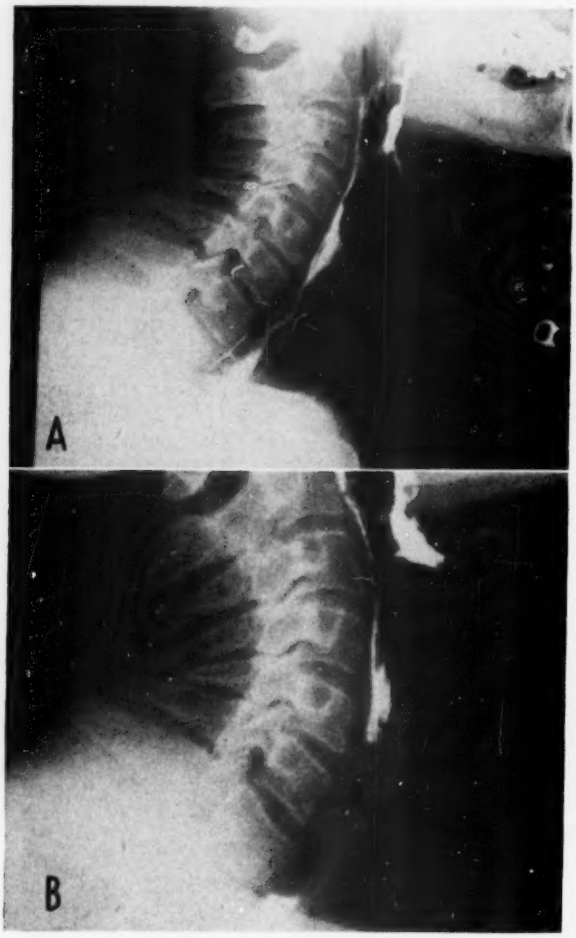

Fig. 10.—*A*, cervical esophagus showing moderate retention of barium in hypopharynx and permanent hypopharyngeal bar at site indicated by arrow. *B*, slight increase in hypopharyngeal bar (*a*) during Valsalva's maneuver.

speaking voice. In a period of three years several x-ray examinations were made. In all these examinations a circumscribed soft tissue swelling was noticed at the level of the sixth and fifth cervical vertebrae which caused compression and slight displacement of the trachea and which was one time more, another time less, marked. After swallowing of barium, there was a moderate retention in the hypopharynx and a permanent hypopharyngeal bar which had caused the soft tissue swelling, as noticed in the plain films. Valsalva's experiment resulted in a slight increase of the spontaneous hypopharyngeal bar (Fig. 10).

CASE 2.—The patient complained of dysphagia for two months. The dysphagia was intermittent and set in suddenly. He had the feeling of a spasm in the throat. When he swallowed saliva, he had the feeling of swallowing an almond. The dysphagia was improved by drinking of whisky. There was definite cancerophobia. There was no pathological condition in the nose and throat, but there was a moderate spontaneous hypopharyngeal bar which was slightly increased by Valsalva's experiment. He was given bromides.

In both instances there was a spontaneous hypopharyngeal bar, the degree of which was slight or moderate. The clinical examination did not reveal a pathological condition of the pharynx or the esophagus in either case, but in both cases there was psychoneurosis. These findings seem to indicate that in psychopathic persons there is occasionally a spontaneous hypopharyngeal bar, the size of which is not proportionate to the degree of the dysphagia. There may or may not be moderate retention of barium in the pharynx in these cases.

CONCLUSIONS

1. The two portions of the inferior constrictor muscle of the pharynx respond in different manners when the pressure in the hypopharynx is increased during Valsalva's experiment. The oblique portion of the muscle yields to the pressure from within and becomes more or less distended, while the circular portion, viz., the cricopharyngeal muscle, responds with a spastic contraction, forming the hypopharyngeal bar.

2. The hypopharyngeal bar per se and the size of the hypopharyngeal bar are dependent on both the pressure in the hypopharynx and the excitability of the cricopharyngeal muscle. They are not dependent on the detachment of the larynx from the vertebrae during Valsalva's experiment.

3. For the clinical evaluation of the hypopharyngeal bar the following criteria must be set up: (*a*) Valsalva's experiment must be properly performed and (*b*) the cervical vertebrae must be normal.

4. The size of the hypopharyngeal bar permits approximate conclusions to be drawn concerning the excitability of the cricopharyngeal muscle.

5. Hypoexcitability of the cricopharyngeal muscle was noticed in two cases of injury to the neck.

6. A unilateral recurrent laryngeal nerve paralysis usually does not interfere with the contractibility of the cricopharyngeal muscle; in some cases it may cause hypoexcitability of the muscle. However, there is frequently difficulty in swallowing, subjective (dysphagia) as well as objective (retention of barium).

7. In functional disorders of the pharynx there is frequently hyperexcitability of the cricopharyngeal muscle associated with moderate and periodical dysphagia. In approximately 50% of the cases there is retention of barium.

8. Barium retention, though not of excessive degree, may occur in patients who do not show signs of a malignant lesion in a period of several years.

9. The transitory hypopharyngeal bar is due to spastic contraction of the cricopharyngeal muscle, while the spontaneous, or permanent, hypopharyngeal bar is caused by permanent spasm of the cricopharyngeal muscle.

10. A spontaneous hypopharyngeal bar is frequently noticed in diseases of the pharynx or close to the pharynx. It is associated with a retention of barium and is usually associated with dysphagia.

11. The finding of a permanent hypopharyngeal bar in carcinoma of the hypopharynx indicates that the tumor has not involved the cricopharyngeal sphincter.

12. In psychopathic persons there is occasionally a spontaneous hypopharyngeal bar of moderate degree, the size of which is not proportionate to the degree of the dysphagia.

425 Mt. Prospect Ave.

Case Reports

FACIAL PAIN FROM ELONGATED STYLOID PROCESS

THOMAS E. DOUGLAS Jr., M.D.
SEATTLE

BIZARRE symptoms are often lightly cast aside as a diagnosis of psychoneurosis is placed on the patient's chart. Globus hystericus is a prime example. The Plummer-Vinson syndrome, neoplasms of the hypopharynx or of the cervical esophagus, paralysis of the pharyngeal and palatal muscles, stenoses, or strictures of the inferior pharyngeal constrictor region, and foreign bodies in this area are often missed because adequate histories are not taken and physical examinations and studies are not made.

Largely through the efforts of Dr. W. W. Eagle [1] the symptomatic styloid process has become recognized as an entity to be sought in routine examinations. Dr. Eagle and Dr. Fritz [2] have presented the usual symptoms of an elongated styloid process as dysphagia, frequent swallowing, increased salivation, fulness in the throat or a sore throat, a feeling that food has lodged in the throat, and sharp, lancinating pains in the ear. They describe the post-tonsillectomy patient who complains that his fossa "hasn't healed" as a probable candidate for this syndrome. Dr. Eagle [1c,d] has stated that the carotid syndrome and migraine headache may be produced by the styloid process.

This paper does not propose to review the dozen case reports of the American and European literature but merely presents an additional case of syndrome associated with an elongated styloid process, namely, pain radiating along the third division of the trigeminal nerve.

REPORT OF A CASE

Mrs. L. V., a 31-year-old white housewife, presented an outstanding, chief complaint of severe, sharp, excruciating pain commencing over the left parotid region which radiated along the ramus and body of the left mandible and to a lesser degree over the left cheek and digastric regions. It was accentuated by chewing and by opening the mouth. Sometimes she suffered from severe lancinating pains in the left ear. Further questioning elicited that there was painful swallowing of almost two years' duration. She described her throat as feeling "swollen, as if something were in it," causing her to swallow frequently in an attempt to relieve this sensation. These symptoms varied with the weather; they were worse on damp cold days and absent during warm dry periods.

She visited her dentist several times in the spring of 1950 for the mitigation of her toothaches. Extraction of the left maxillary and mandibular molars and premolars failed to

1. (*a*) Eagle, W. W.: Elongated Styloid Processes: Report of 2 Cases, Arch. Otolaryng. **25**:584 (May) 1937; (*b*) Some Otolaryngological Topics of Interest to Internist, Virginia M. Monthly **74**:4 (Jan.) 1947; (*c*) Elongated Styloid Process: Further Observations and New Syndrome, Arch. Otolaryng. **47**:630 (May) 1948; (*d*) Symptomatic Elongated Styloid Process: Report of Two Cases of Styloid Process—Carotid Artery Syndrome with Operation, Arch. Otolaryng. **49**:490 (May) 1949; (*e*) Personal communication to the author.

2. Fritz, M.: Elongated Styloid Process: Cause of Obscure Throat Symptoms, Arch. Otolaryng. **31**:911 (June) 1940.

produce the desired result. Indeed, she stated that the "extracted teeth still hurt and the gums don't feel healed."

Progression of the symptoms caused her to consult a nose and throat specialist in September, 1950. He reported the physical examination of the head and neck as giving "negative" results and stated that the alveolar ridges were "completely healed," and he could find no cause for the patient's complaints. The patient was seen by otolaryngologists in October, 1950, and again in December, 1950, for the same symptoms. Each physician dismissed her from his services with a report of a negative physical examination. The only advice she received was to "stop worrying" about her symptoms and to "stop taking" the acetylsalicylic acid and acetophenetidin pills which she was employing rather frequently in a vain attempt to lessen the discomfort and pain.

Fig. 1.—Arrow indicates the position of the left styloid process in the posteroanterior position. It has been inked over to allow better visualization for publication.

Past Medical History.—The history was negative for ear infections and allergy. She had not been excessively troubled with upper respiratory infections and sore throats as a child but had had whooping cough. Empyema followed lobar pneumonia in 1938, necessitating two open drainages, with rib resection. Frequent bouts of hemoptysis and a chronic productive cough continually plagued the patient after the episode of empyema. In 1940 she underwent an adenotonsillectomy operation to eliminate "the trouble causing the cough." Her symptoms, however, persisted, and finally a massive hemorrhage occurred, requiring hospitalization. Acid-fast bacilli had never been found in repeated smears and cultures over a 10-year period. On Feb. 6, 1948, a left lower lobectomy was performed to remove the bronchiectatic pulmonary tissue. An uneventful postoperative course was encountered, and the patient has been asymptomatic of pulmonary disease since the lobectomy.

Physical Examination.—When the patient was referred to the clinic, on Sept. 26, 1951, the following findings were of note regarding the physical examination. The patient was a white woman apparently of the stated age. She was well nourished and appeared in no distress, although her brow was slightly furrowed. The skin of the face and neck was not unusual. The scalp was normal. The turbinates were pale and moderately enlarged. Examination of the mouth revealed a normal appearance of the mucous membranes. The gums over the cavities left by the extirpated molars and premolars of the left upper and lower jaws were normal. There was normal motility of the face, tongue, soft palate, and pharynx. The mucous membrane of the pharynx was normal. The pharyngeal tonsils were absent, and their fossae appeared normal on visualization. Laryngeal and nasopharyngeal examinations gave negative results as did palpation of the neck. Excursions of the temporomandibular points were normal. Upon digital examination the oral cavity was found to be normal. As the palpating finger was pressed against the left tonsillar fossa, a hard, pointed, and rather immobile object was encountered near the anterior pillar at the level of the superior alveolar ridge. Reproduction of the pain along the face, in the ear, and in both jaws occurred with lateral displacement of this hard pointed object. A diagnosis of symptomatic elongated styloid process was made.

Fig. 2.—Arrow indicates the position of the left styloid process in the lateral position. It has been inked over to allow better visualization for publication.

The report of the roentgenologist was nonspecific, although he felt that the shadow, as indicated by the arrows in Figures 1 and 2, might be the styloid process or its ossified stylohyoid ligament. Postoperative films failed to show this area of contrast, so the roentgenologist made his report more definitive.

Operative Procedure and Postoperative Course.—The patient was admitted to the hospital on Oct. 3, 1951, for the removal of the left styloid process. With the use of 0.5% procaine hydrochloride anesthesia a 1.5-cm. incision was made near the junction of the soft palate with the anterior tonsillar pillar at the level of the superior alveolar ridge. Dissection was carried to the hard pointed object, which proved to be the styloid process. As the dissection progressed, it was noted that the styloid process very closely approximated the medial aspect of the ramus of the mandible. It was grasped with a hemostat and severed near its base with shears. The incision was closed with two absorbable surgical sutures, U. S. P.

A nasal feeding tube (No. 14 catheter) was pulled out by the patient an hour after its insertion; so she was placed on a soft diet. She was given 100,000 units of penicillin intramuscularly twice daily for three days and 0.5 gm. of streptomycin orally twice daily for one day. The oral temperature reached 101 F. 36 hours after operation, then gradually subsided to normal by the third postoperative day. She was discharged on the fourth postoperative day.

After discharge she was asymptomatic for 2½ weeks. She then had a 10- or 11-day period of tingling following the course of the facial distribution of the preoperative pain. Since then, however, she has been asymptomatic. She no longer has pains in the face or the ear, fulness in the throat, frequent swallowing, or excessive salivation. Mandibular excursions fail to provoke tightness or pain, as was true before the operation.

COMMENT

The symptomatic elongated styloid process is probably commoner than the literature indicates. Routine finger palpation of the tonsillar fossae in obscure cases will result in a definitive diagnosis in some cases. This patient had been labeled as having a psychoneurosis by several physicians. No one was more surprised than I to discover the symptomatic styloid process. The bizarreness, the vagueness, and the indefiniteness of the symptoms plus the normal appearance of the membranes caused me to place the diagnosis of psychoneurosis foremost in my mind until I happened to palpate the symptomatic styloid process. In three other cases since then the diagnosis has been made and treatment carried out for symptomatic elongated styloid process. Palpation with the finger is, indeed, a worth-while procedure.

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Clinical Notes, New Instruments and Techniques

NEW BRONCHOTELESCOPES

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BORAS, SWEDEN

Modern bronchoscopy with the ever-growing tasks for the bronchoscopist demands an absolutely perfect armamentarium. It is true that the more mechanical instruments for this branch of surgery, for instance, bronchoscope tubes, excision forceps, and foreign-body forceps, have shown marked improvement during the last decades, but the purely optical instruments, i. e., the telescopes—though of highest importance—were hardly improved at all during the later years. The most important qualities of an adequate optical system for bronchoscopes are, primarily, a perfect illumination system which directs the light upon the objective as intensely as possible and, secondarily, a lens system with a high quality of light transference which can be focused from a very near distance to an infinite one.

In my opinion, the bronchotelescopes used up to now in our hospitals do not answer the demands mentioned above. Together with M. Aust, an engineer from the firm of Kifa in Stockholm, I endeavored to design a completely new bronchotelescope. This is now finished and has been tested and used in several ear departments of the leading hospitals of Sweden. Instead of the open bulb used up to now, the illumination problem has been solved in this telescope by a special projector illumination (patent pending). The projector concentrates the light rays in the same direction as the angle of vision of the telescope lens. The condenser of the projector concentrates the light on the objective and intensifies it without overheating the lamp. The window of the projector is situated close to the lens of the objective; i. e., the critical distance is small, and even bronchi with small openings can be illuminated and examined.

The optical system consists of a lens combination—Zeiss-Kollmorgen system—which in itself has the highest quality of light transference. In order to increase this quality additionally, the lens system has been coated, thus reducing the otherwise unavoidable reflections between the lenses to an absolute minimum. Practically speaking, the coating means an increase in light intensity of approximately 30% in comparison with an uncoated system.

In bronchoscopic examinations the distance between the object and the lenses often varies considerably. When the wall of a lobe is being scrutinized, for instance, the distance will be very small; when the bronchial lumen is being observed, the distance can be many times longer. Therefore, the perfect telescope must have a lens system adjustable to the various distances. The newly designed telescope is equipped with such a system, i. e., a Ramsden ocular, which can be focused from near to infinite distance. This focusing quality offers to the examiner all possibilities, from a mere microscopic view of a mucous membrane to an all-round examination of the most distant part in a bronchial lumen. The accompanying diagram (Fig. 1) shows the magnification with various working distances.

The telescopes are delivered in two different calibers: the standard model, with an exterior diameter of 5.2 mm., and an especially thin model, with an exterior diameter of 3.8 mm. The effective length of both models is 465 to 475 mm. The standard model fits bronchoscope tubes of normal diameter of all makes and models. The thinner model, of 3.8 mm., is especially designed for children and for examination of the bronchial lumen, which cannot be examined with the thicker telescope. The thinner model is especially indicated for examination of the lower lobes. The thicker model is, as a rule, employed for examination of the upper lobes.

From Borås County Hospital.

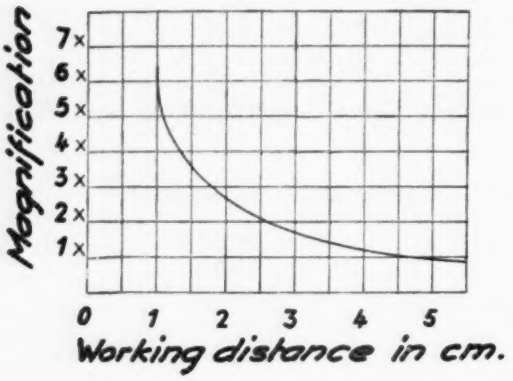

Fig. 1.—Magnification with various working distances.

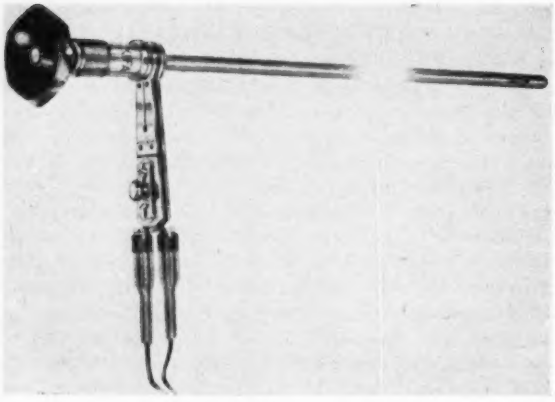

Fig. 2.—Bronchotelescope.

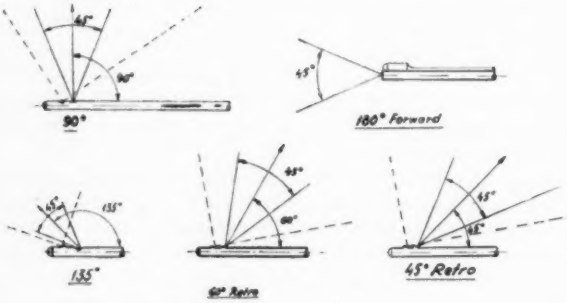

Fig. 3.—Angles of vision.

The standard telescopes are manufactured with the following angles of vision:

Degrees	Vision
90	= right angle
135	= forward oblique
180	= straight forward
60	= retrograde oblique
45	= retrograde

The thinner model is supplied for the following angles of vision:

Degrees	Vision
90	= right angle
135	= forward oblique

All these optical systems have a projection angle of 45 degrees, meaning that together they cover an area of 157.5 degrees, i. e., almost the total area of 180 degrees.

Apart from the above-mentioned telescopes, an additional accessory for the bronchoscope has been designed for straight forward examination which can be used for probe excisions or for the removal of foreign bodies if a minor magnification is sufficient. This complement is equally provided with a Ramsden ocular and offers a magnification of 2½ times. A plane cover slice, which can easily be cleaned, offers protection against coughed-up particles. The complement can be adjusted to the bronchoscope tube on a swinging arm and can therefore be turned to the side. The distance between the bronchoscope and the head end of the complement is large enough to allow use or introduction of instruments during the examination. The complement can be delivered with fixation for the different bronchoscope types.

Experience with these new instruments, based on more than a thousand bronchoscopic examinations, shows that in examinations of the upper lobes the use of the standard model, i. e., the thicker model, is indicated, especially the one with the 90-degree vision. This indication is especially true for the right upper lobes. For the left upper lobes, besides the 90-degree vision model, the telescopes with 60 and 135-degree vision angles may be used. On rare occasions even the 45-degree vision angle model may be useful. For the lower lobes especially, the thinner model with a 135-degree vision angle is indicated, which offers the best all-round view. The lobes of the middle bronchi and the stem of the lower lobes are best examined with the help of the straight forward model or with the complement.

Last but not least, I wish to point out that the examiner who has not yet had thorough experience with bronchoscopic examination and the use of bronchotelescopes needs some practice to obtain the important results which these optical instruments are able to offer.

NEW EAR SUCTION TUBES

SHIRLEY HAROLD BARON, M.D.
SAN FRANCISCO

There are certain situations in which ear suctioning is facilitated by a tube of very small caliber. The tubes presented qualify for this specification with an over-all diameter of only 1.5 mm. (Fig. 1).

One tube has a finger cut-off (Fig. *2 A*). This is especially useful in suctioning blood between the bony and the membranous external auditory canal when the membranous canal is being separated in the fenestration operation. The amount of suction permitted by the tube is adequate to keep the field clean but is not of sufficient force to cause trauma to the membranous canal.

The suction tube without a finger cut-off (Fig. *2 B*) is very useful in office practice. It is a timesaver in cleaning discharging ears. Its small caliber allows its use through a magnifying otoscope without obstructing vision of the field. The middle ear can be suctioned directly through large and small tympanic membrane and attic perforations. The tube can be inserted into a myringotomy opening and is very helpful in evacuating middle ear fluid of a viscid, gummy, stringy consistency.

The connecting end of this suction tube has an inner diameter that will accept a Luer syringe should one, for any reason, wish to inject "washes" or medicaments.

These instruments are made by the Storz Instrument Company of St. Louis.

516 Sutter Street (*2*).

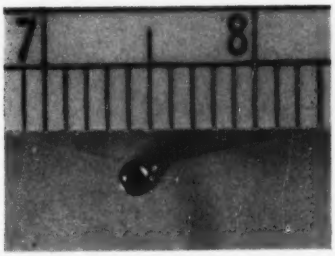

Fig. 1.—New ear suction tube with diameter of 1.5 mm.

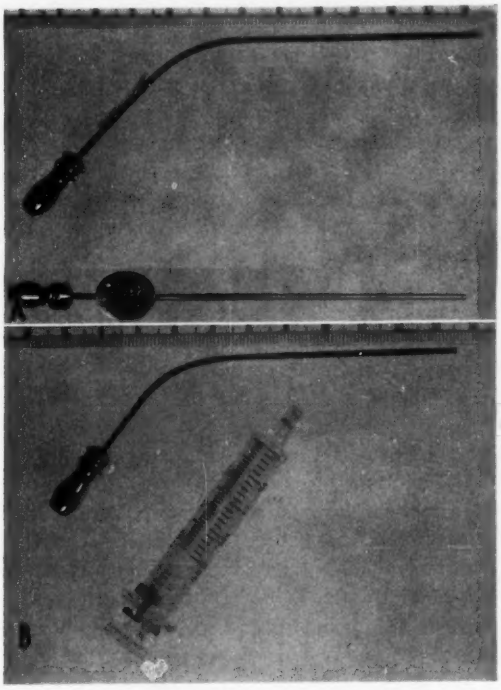

Fig. 2.—*A*, new ear suction tube with finger cut-off. *B*, new ear suction tube without finger cut-off.

Progress in Otolaryngology

Summary of the Bibliographic Material Available in the Field of Otolaryngology for 1949 to 1951

TUMORS OF THE NOSE AND THROAT

FREDERICK A. FIGI, M.D.
AND
KENNETH D. DEVINE, M.D.
ROCHESTER, MINN.

(Continued from Page 555)

TUMORS OF THE NOSE AND PARANASAL SINUSES

FRIEDMANN [1] decribes his experience with the Papanicolaou technique of exfoliative cytology as applied to the diagnosis of tumors of the throat, nose, paranasal sinuses, and ear. Secretions and specimens were collected on cotton applicators. Specimens collected at the time of direct laryngoscopy proved more suitable than material collected at indirect laryngoscopy. The material obtained was smeared on glass slides, and the wet slide was dropped immediately into fixative (equal parts of absolute alcohol and ether).

Friedmann's report is based on the examination of about 1,300 smears in 212 cases in which the presence of malignant disease was suspected. False negative results were reported in 2.3%, and false positive results were reported in 4.2% of the cases. The method is of value and can supply useful information in the following instances: (1) when biopsy is impossible because of the site of the growth or because of the patient's refusal; (2) in the presence of positive clinical signs when biopsy discloses no conclusive evidence of malignancy; (3) in cases of preinvasive carcinoma; (4) in cases of doubtful clinical etiology, such as syphilis and obscure "chronic laryngitis," in which cytologic examination of direct smears may throw light on an obscure condition, and (5) in cases of recurrence after treatment.

Schall [2] states that the surgical removal of neoplasms of the nose and nasal sinuses in conjunction with postoperative irradiation is twice as effective as any other type of treatment and should result in a five-year survival rate of 35%. Tumors limited to the nasal cavity can be exposed adequately through a lateral rhinotomy. When involvement of the sinuses is extensive, Schall uses a modified Moure incision to expose the superior maxilla. He advocates intracavitary irradiation and uses a dose of 2,000 to 4,000 mg.-hr. of radium, depending on the sensitivity of the tumor.

Lenz [3] states that the use of radium and x-rays plays an important part in the treatment of malignant neoplasms of the nose, nasopharynx, and paranasal sinuses. The choice of whether to use operation, radiotherapy, or both in an individual case of cancer in this region can best be made by a team consisting of rhinologists and

1. Friedmann, I.: Exfoliative Cytology as an Aid in the Diagnosis of Tumours of the Throat, Nose and Ear, J. Laryng. & Otol. **65**:1-9 (Jan.) 1951.

2. Schall, L. A.: Malignant Neoplasms of the Nose, Paranasal Sinuses and Nasopharynx: Evaluation of Surgical Treatment, Tr. Am. Acad. Ophth. **55**:209-213 (Jan.-Feb.) 1951.

3. Lenz, M.: Malignant Neoplasms of the Nose, Nasopharynx and Paranasal Sinuses: Evaluation of Radiation Therapy, Tr. Am. Acad. Ophth. **55**:214-225 (Jan.-Feb.) 1951.

radiotherapists who have worked together and who have followed each other's work during a period of years in a clinic devoted to follow-up studies in such cases.

The use of irradiation alone ordinarily is inadequate to control malignant disease of the nasal cavity and sinuses, according to Capps.[4] He chooses to treat carcinoma of the nasal cavity and sinuses by x-ray therapy followed by exenteration by means of surgical diathermy. If necessary, radium is applied by placing it on the surface of a mold made to fit the cavity and not by inserting it in the middle of a pack. According to Capps, current surgical procedures should be accomplished by surgical diathermy and coagulation, unless a lateral rhinotomy through the unaffected skin is being performed. Resection of the jaws is unnecessary because it often involves the removal of much healthy tissue and may fail to reach extensions of the tumor. Williams [5] also states that preoperative irradiation should be carried out in such cases.

Perzik [6] states that cancer of the nasal cavity and paranasal sinuses makes up about 0.2% of all malignant tumors. Eighty per cent of the lesions in this region arise in the maxillary antrum. Distant metastasis occurs in not more than 25% of the cases. Lymphosarcoma, plasmacytoma, and highly undifferentiated carcinoma should be treated by the administration of x-rays. The treatment of malignant melanoma and osteogenic sarcoma is strictly surgical. In about 99% of malignant tumors of the nasal cavity and sinuses, the lesion is carcinoma (adenocarcinoma in 9% and squamous-cell carcinoma in 90%). It is in the treatment of squamous-cell carcinoma that primary radical operation, combined with postoperative irradiation, if necessary, is recommended. The use of cautery as a surgical tool is shunned. Perzik recommends the use of the scalpel and gives several reasons for this decision.

High [7] reports two cases of sarcoma of the nose and sinuses. The first case was unusual because a chondrosarcoma apparently developed within a mucocele. The second case was of a primary chondrosarcoma of the nasal septum. No such case has previously been reported in the medical literature, according to High.

Heck, Hallberg, and Williams [8] studied the records of 64 cases in which there was a diagnosis of antrochoanal polyp. Fifty-nine per cent of the patients involved received surgical treatment. Recurrences were noted in 5.5% of the cases in which the external antral approach was used and in 28.2% of the cases in which avulsion or removal through an antral window was employed. Antrochoanal polyps do not occur predominately in children but affect persons in various age groups rather uniformly. No bilateral antrochoanal polyps were found. The frequently seen dumbbell-like shape of the intact antrochoanal polyp is characteristic. Nasal polyps frequently contain mucous glands, but antrochoanal polyps almost never contain them.

4. Capps, F. C. W.: Discussion on Malignant Diseases of the Nasal Cavity and Sinuses, Proc. Roy. Soc. Med. **43**:665-671 (Aug.) 1950.

5. Williams, I. G.: Carcinoma of the Antrum, Proc. Roy. Soc. Med. **43**:671-674 (Aug.) 1950.

6. Perzik, S. L.: Management of Cancer of the Nasal Cavity and Paranasal Sinuses, California Med. **74**:374-376 (May) 1951.

7. High, H. C.: Sarcoma of the Nose and Sinuses, Laryngoscope **61**:803-817 (Aug.) 1951.

8. Heck, W. E.; Hallberg, O. E., and Williams, H. L.: Antrochoanal Polyp, Arch. Otolaryng. **52**:538-548 (Oct.) 1950.

Thorpe [9] presents three cases of nasoalveolar cysts, in one of which the cysts were bilateral.

Rawson, Eyler, and Horn [10] studied the histologic characteristics in nine cases of plasma-cell tumor that involved the upper parts of the respiratory and the alimentary tracts. They compared the microscopic findings in these nine cases with those in nine cases of multiple myeloma and with those in a variety of other lesions in which plasma cells were an especially conspicuous feature. The replacement of tissue by broad sheets of plasma cells arranged on a delicate capillary stroma is indicative of a malignant plasma-cell tumor. The absence of this pattern makes it unlikely that a plasma-cell tumor is malignant. Benign plasma-cell lesions of the upper part of the respiratory tract may be treated adequately by surgical excision. The malignant plasma-cell neoplasms respond well to radiotherapy. In the cases reported, recurrence was the rule when surgical removal was employed.

Knight [11] presents two cases of plasmacytoma of the lateral nasal wall. He remarks that the incidence of diagnosis of extramedullary plasma-cell tumor, or plasmacytoma, of the upper part of the respiratory passages is undergoing a remarkable transition. In 1932, a diagnosis of this tumor was sufficiently rare to warrant the reporting of individual cases. By 1943, the number of reported cases amounted to 64. From 1943 to the time of his study, the literature had increased so extensively as to make enumeration of cases difficult. He is of the opinion that plasmacytoma is a primary neoplasm and not a manifestation of multiple myeloma. In all cases, the tumor should be considered malignant.

Switzer, Moseley, and Cannon [12] present an unusual case of extramedullary plasmacytoma that involved the pharynx, skin, and mucous membranes. The site of predilection for extramedullary plasma-cell tumors is the upper part of the respiratory tract.

Pastore, Sahyoun, and Mandeville [13] present a case of rhabdomyosarcoma of the right maxillary antrum in a 46-year-old man. Differences exist between a granular-cell myoblastoma and a true rhabdomyosarcoma. Striations in the cytoplasm of the tumors are not considered a prerequisite for the diagnosis. When special stains disclose striations in a few cells, the diagnosis is considered to be established. The case presented is interesting because examination of the tumor revealed striations and bizarre forms of malignant giant cells and mitotic figures. Surgical extirpation followed by therapy with radium and x-rays resulted in at least a seven-year cure.

9. Thorpe, P. A.: Report of 3 Cases of Naso-Alveolar Cysts, J. Laryng. & Otol. **64**:640-641 (Oct.) 1950.

10. Rawson, S. J.; Eyler, P. W., and Horn, R. C., Jr.: Plasma Cell Tumors of the Upper Respiratory Tract: A Clinico-Pathologic Study with Emphasis on Criteria for Histologic Diagnosis, Am. J. Path. **26**:445-461 (May) 1950.

11. Knight, L. L.: Plasma Cell Tumors of the Paranasal Sinuses: Report of 2 Cases, J. Tennessee M. A. **43**:226-229 (July) 1950.

12. Switzer, P. K.; Moseley, V., and Cannon, W. M.: Extramedullary Plasmacytoma Involving Pharynx, Skin and Lymph Nodes, Arch. Int. Med. **86**:402-411 (Sept.) 1950.

13. Pastore, P. N.; Sahyoun, P. F., and Mandeville, F. B.: Rhabdomyosarcoma of the Maxillary Antrum: 7 Year Survival Following Surgical Excision and Radiation Therapy, Arch. Otolaryng. **52**:942-947 (Dec.) 1950.

In an excellent article on the subject of nasal gliomas, Black and Smith [14] present two cases of such tumors in which there was recurrence at the site of removal. It is generally agreed that these lesions are benign, but little evidence exists to indicate whether they have the properties of growth that are characteristic of a benign neoplasm or whether they are simply malformations. Recurrence indicates that some of these lesions have characteristics of low-grade neoplasms. Miller and Neidhardt [15] present a case of extranasal glioma in an infant.

Schall and Lineback [16] add three cases of primary intranasal neuroblastoma, making a total of 17 cases described in the literature. The origin of the tumor still is obscure, but the prevailing opinion is that it arises from ectoderm, more precisely from the olfactory membrane. Clinicians and pathologists are familiar with neuroblastomas as they occur in the adrenal gland and sympathetic ganglia and as they metastasize to the skull and liver. Physicians also are familiar with retinoblastoma, which is the counterpart of this lesion in the eye. There are, however, scanty reports and even less knowledge concerning what has been termed by European authors "esterio-neuroblastoma" of the nose. Such a tumor originates independently in the nasal fossa, is unrelated to tumors of the central nervous system and the viscera, and sometimes is malignant. More frequently, however, as in the present three cases, it is benign. It appears only in adults and at first examination presents the clinical appearance of a bleeding nasal polyp.

Hung [17] presents a case of lymphangioendothelioma in which the primary growth occurred in the nose. The growth was considered to be primary in the right middle meatus and had no relation to the paranasal sinuses.

Kay, Lees, and Stout [18] present three cases of pituitary chromophobe adenoma in which the nasal cavity was sufficiently involved to produce obstruction and other symptoms. Although involvement of the nasopharynx is not infrequent, invasion of the nasal cavity by this tumor must be extremely rare, since these three cases are the only examples in which such invasion occurred among 192 cases of pituitary adenoma recorded at the Neurological Institute. In one additional case, an area of direct invasion of the roof of the posterior nasal cavity measuring 0.75 cm. in diameter was noted at necropsy. This invasion of the nasal cavity manifests itself by the formation of polyps composed of adenoma cells in the region of the posterior ethmoid bone or the middle meatus on one or both sides. The literature contains reports of only two similar cases.

Baer and Alexander [19] report a case of a mixed tumor in the right nasal cavity of a 28-year-old woman.

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14. Black, B. K., and Smith, D. E.: Nasal Glioma: 2 Cases with Recurrence, Arch. Neurol. & Psychiat. **64**:614-630 (Nov.) 1950.

15. Miller, G. V., and Neidhardt, H. W.: Extranasal Type of Nasal Glioma: Report of a Case, J. Pediat. **36**:798-800 (June) 1950.

16. Schall, L. A., and Lineback, M.: Primary Intranasal Neuroblastoma: Report of 3 Cases, Ann. Otol. Rhin. & Laryng. **60**:221-229 (March) 1951.

17. Hung, W.-C.: Primary Lymphangioendothelioma of the Nose, Arch. Otolaryng. **52**: 278-283 (Aug.) 1950.

18. Kay, S.; Lees, J. K., and Stout, A. P.: Pituitary Chromophobe Tumors of the Nasal Cavity, Cancer **3**:695-704 (July) 1950.

19. Baer, S., and Alexander, C. M.: Mixed Tumor of Salivary Gland Type in the Nose, New York J. Med. **50**:2206 (Sept. 15) 1950.

Gerity [20] presents two cases of rare tumors of the nasal cavity. He chose to classify one as cystic basal-cell carcinoma and one as adenocarcinoma. He reviews the literature concerning these tumors.

Moore [21] presents three cases of osteoma of the paranasal sinuses. This is a unique presentation in that he emphasizes the histopathology of this fairly uncommon tumor. In the three cases described the osteomas showed gross and microscopic evidence of dense lamellar bone and also of spongy bone. The pedicles consisted primarily of spongy bone, whereas the peripheral portions contained denser lamellar bone. Bony formation apparently was derived primarily from metaplasia of the connective tissue penetrating the trabeculae from the pedicle. Some bony formation probably occurred from the periosteum at the periphery of the tumor by an osteoblastic process.

Murphey [22] presents the clinical data in five cases of osteoma of the frontal sinus. The tumors were discovered among 18,076 patients admitted to the hospital. The osteoma in one case showed signs of increased growth and was removed. In a second case there was a history of trauma as a possible inciting cause.

A case of orbitoethmoidal osteoma in a 23-year-old man is presented by McKibben and Casey.[23]

Ball [24] presents a case of ossifying fibroma of the frontal sinus. Only one other report of any similar lesion was found in otolaryngological journals.

Collins and Pool [25] present the details of their method of treatment of cancer of the maxillary antrum by a combination of operation and use of radium. The operation may be limited to peroral resection of the antral floor. This operation is especially applicable to lesions in the lower part of the antrum and when palliation is intended. A more radical resection of the maxilla can be carried out through the Weber-Ferguson incision. A radium applicator usually can be tolerated for 10 to 14 days after operation. An impression of the region is taken, and an applicator is fashioned in acrylic. Maximal dosage of radium is usually a caustic dose, and sloughing will occur. A period of four to six months of local discomfort usually is noted.

Hill and Goodof [26] present a case of carcinoma occurring in an antroalveolar fistula that had been present 20 years. They state that this experience demonstrates that all antroalveolar fistulas should be closed.

A case of myxoma of the left maxillary sinus in a 2-year-old boy is presented by Greenfield and Friedman.[27] This case is added to five cases of myxoma of the

20. Gerity, P. J.: Unusual Nasal Tumors: Report of 2 Cases, Arch Otolaryng. **52**:188-201 (Aug.) 1950.

21. Moore, J. A.: Osteoma of the Paranasal Sinuses with Report of 3 Cases, Laryngoscope **61**:379-399 (May) 1951.

22. Murphey, H. S.: Osteoma of the Frontal Sinus, Texas J. Med. **46**:641-645 (Aug.) 1950.

23. McKibben, B. G., and Casey, E. R., Jr.: Orbitoethmoidal Osteoma, A. M. A. Arch. Otolaryng. **53**:552-555 (May) 1951.

24. Ball, S.: Ossifying Fibroma of the Frontal Sinus, A. M. A. Arch. Otolaryng. **53**:460-465 (April) 1951.

25. Collins, V. P., and Pool, J. L.: Treatment of Antral Cancer by Combined Surgery and Radium Therapy, Radiology **55**:41-44 (July) 1950.

26. Hill, F. T., and Goodof, I. I.: Carcinoma Occurring in an Antro-Alveolar Fistula: Case Report, Ann. Otol. Rhin. & Laryng. **60**:238-241 (March) 1951.

27. Greenfield, S. D., and Friedman, O.: Myxoma of Maxillary Sinus, New York J. Med. **51**:1319-1320 (May 15) 1951.

nose and sinuses previously reported. A myxoma is a tumor of mesenchymal origin that reproduces with some degree of accuracy the appearance of primitive mesenchyme. Rarely portions of it may become denser and resemble fibrosarcoma. It generally infiltrates surrounding tissues.

Belal [28] reports a case of mucocele of the left maxillary sinus. This is a rare condition. Anthony and Williams [29] report a case of mucocele of the antrum associated with mucocele of the sphenoid sinus, with extensive erosion of the roof of the ethmoid bone and destruction of the sella turcica. This finding led to the erroneous clinical diagnosis of an inoperable malignant neoplasm.

McCart [30] states that the disease known as malignant granuloma of the nose presents a challenge to the physician, especially the otolaryngologist, as to its diagnosis and treatment. According to McCart, the first case of this disease was described by Peter McBride, in 1896. Sir Robert Woods, in 1921, was the next to write about this condition. J. P. Stewart collected all the cases reported in the literature until the year 1933 and found 10 in all. The total of cases so far recorded is 17. The course of the disease is obscure. It originates in the nose, with widespread lesions in other parts of the body. There are three stages: 1. The prodromal stage may last four years. The only symptom may be a stuffy nose. 2. In the active stage, nasal obstruction, ulceration of the palate, crusting of the nose, ulceration of the septum or inferior turbinate, and hemorrhage may occur. 3. In the terminal stage, extensive destruction of the palate, nose, and face occurs, and the patient dies of exhaustion.

Woodburn and Harris [31] present six cases of idiopathic lethal granulomatous ulceration of the nose and face. Cortisone and corticotropin (ACTH) appear to be the only therapeutic agents of value at present, and, since they may effect only temporary remission of the lesion, their significance has yet to be fully assessed. It is the opinion of these workers that a therapeutic agent for effective cure remains to be discovered, and, as other authors have pointed out, much investigation must be done to establish the etiologic agent concerned in this affliction.

TUMORS OF THE NASOPHARYNX

According to Eberhard and Leaming,[32] the treatment of carcinoma of the nasopharynx by x-ray therapy involves three basic problems: (1) localization of the lesion, (2) delivery of an adequate amount of x-rays, and (3) maintenance of the patient's health throughout the ordeal. Biopsy is important, but to distinguish among the carcinomas, lymphoepitheliomas, and lymphosarcomas is relatively unimportant so far as treatment is concerned, since the individual variation in radiosensitivity within each group is so great as to make it unsafe to reduce the dosage simply because of the histologic appearance of the lesion. The latter is of considerable prognostic importance, however, for most therapeutic successes will occur in the course of treatment of lymphosarcomas and lymphoepitheliomas and only a few in

28. Belal, A.: Mucocele of the Maxillary Sinus, J. Laryng. & Otol. **65**:286-288 (April) 1951.

29. Anthony, W. P., and Williams, H. L.: Unilateral Pansinal Mucocele Simulating a Malignant Neoplasm: Report of a Case, A. M. A. Arch. Otolaryng. **53**:189-194 (Feb.) 1951.

30. McCart, H.: Malignant Granuloma of the Nose, Canad. M. A. J. **63**:357-361 (Oct.) 1950.

31. Woodburn, C. C., Jr., and Harris, H. E.: Idiopathic Lethal Granulomatous Ulceration of the Nose and Face: Report of 6 Cases, Cleveland Clin. Quart. **18**:165-178 (July) 1951.

32. Eberhard, T. P., and Leaming, R. H.: Treatment of Carcinoma of Nasopharynx by Irradiation, Radiology **55**:46-51 (July) 1950.

the course of treatment of the differentiated carcinomas. The ideal goal is the administration of a minimal dose of 4,000 to 4,500 r to all parts of the tumor in four weeks. The primary lesion is treated through two lateral fields and two antral fields. If the appearance of severe cutaneous reactions or the presence of high radioresistance on the part of the local lesion renders it evident that a sufficient amount of x-rays cannot be delivered to the nasopharynx through external ports, radium may be applied locally. According to Eberhard and Leaming, before treatment is started both the patient and the family should be given a very dark picture concerning the sequence of events should a reaction occur.

Kramer [33] states that radiotherapy must aim at the eradication of malignant tumors of the nasopharynx with the first course of treatment, as recurrent lesions hardly ever can be treated successfully. In the majority of patients who die of cancer of the nasopharynx, either recurrence or death occurs within two years after the first treatment. Therefore any patient who remains free from any signs of disease for three years after treatment stands a good chance of permanent recovery. Among the patients treated by Kramer, 25% were cured for five years or more. Among the patients with lymphoepithelioma there were the most cures for five years (40%) and among the patients with undifferentiated carcinoma the five-year cure rate was 36%. Seventy-seven per cent of differentiated squamous-cell carcinomas and transitional-cell carcinomas invaded the base of the skull, whereas the incidence of such invasion was only 24% for the whole group of patients. Cervical lymph nodes were involved by metastasis in only 44% of the patients with differentiated squamous-cell carcinoma and transitional-cell carcinoma, whereas such metastasis occurred in 76% of the whole series of patients.

Schoolman [34] discusses the diagnosis and prognosis of malignant tumors of the nasopharynx. He states that topical anesthesia frequently is required for adequate examination of the nasopharynx. The postnasal mirror is the most effective instrument for the examination of the pharyngeal vault. Biopsy should be done on all abnormal tissue. Epstein [35] states that it is generally agreed that most nasopharyngeal tumors, exclusive of those arising as primary or metastatic growths in the subadjacent bone, originate in the soft tissues of the nasopharynx. The roentgenologic identification of changes in the soft tissue occasionally is mentioned as an important sign of such tumors, but further efforts to portray these more clearly are required. Efforts should be increased to demonstrate abnormal shadows produced by soft tissue and when these are found to insist that they be investigated further clinically. With the frequent use of x-ray examination of the nasal sinuses in patients with symptoms referable to the upper part of the respiratory tract, a great opportunity exists for the detection of abnormalities in the soft tissue of the nasopharynx. Roentgenograms taken with the patient in the lateral position should be examined carefully with this fact in mind, and laminography in the midline may be of great assistance in the evaluation of abnormal changes in the soft tissue in this region.

33. Kramer, S.: The Treatment of Malignant Tumours of the Nasopharynx, Proc. Roy. Soc. Med. **43**:867-874 (Nov.) 1950.

34. Schoolman, J. G.: Diagnosis and Prognosis of Malignancy of the Nasopharynx, Ann. Otol. Rhin. & Laryng. **60**:163-167 (March) 1951.

35. Epstein, B. S.: Laminography in the Diagnosis of Nasopharyngeal Tumors, Radiology **56**:355-362 (March) 1951.

In Epstein's series of 10 cases, abnormalities in the soft tissue could be noted in each instance on the laminograms. Routine stereoroentgenograms showed a definite shadow produced by soft tissue in only three instances.

Miller [36] and Hickey,[37] in separate papers, review the literature as it pertains to nasopharyngeal tumors and stress the importance of early diagnosis. Hickey also presents a group of 24 cases of nasopharyngeal malignant tumor.

Martin and Quan [38] state that great susceptibility to cancer of the nasopharynx is present in Chinese people. At Memorial Hospital in New York City, 45 Chinese patients with cancer of the upper parts of the respiratory and alimentary tracts were observed during the 15-year period from 1935 to 1949 inclusive. Of these lesions, 37 (82%) were cancer of the nasopharynx. This figure is compared to an expected incidence of 5.5% as based on the over-all incidence at Memorial Hospital.

Kerwin [39] is of the opinion that radiation and hormonal (androgenic) therapy offers the best possibility for control of juvenile nasopharyngeal angiofibroma. The most conservative therapy always is employed because of the usual spontaneous regression of the tumor at maturity.

TUMORS OF THE LARYNX AND TRACHEA

Kernan [40] made serial sections of a number of larynxes involved with carcinoma and reconstructed them in wax. In each case of malignant tumor of the larynx, every means of diagnosis should be used. These measures should include not only examination by mirror but also careful direct examination, tomographic examination, x-ray examination by the Robert-Laroux technique, and, finally, study of the histopathology. Kernan states that indirect methods of obtaining specimens for biopsy are inefficient for the diagnosis of carcinoma of the larynx. For the performance of a truly trustworthy biopsy, the specimen should always be removed by means of direct laryngoscopy.

Kaplan [41] suggests a classification of cancer of the larynx based on depth of the lesion as well as surface extension and on whether the growth originated in mucosa, with or without basement membrane. His classification includes the following categories:

1. Intrinsic superficial (treated equally well by surgical removal or irradiation): The neoplasm so classified lies within the rim of the larynx and originates from epithelium with a basement membrane. It is considered clinically superficial because the musculature is not infiltrated; that is, the vocal cords are not fixed.

36. Miller, D.: Nasopharyngeal Cancer, Laryngoscope **61**:187-214 (March) 1951.

37. Hickey, H. L.: Nasopharyngeal Malignant Tumor: An Overlooked Condition, A. M. A. Arch. Otolaryng. **53**:53-67 (Jan.) 1951.

38. Martin, H., and Quan, S.: The Radical Incidence (Chinese) of Nasopharyngeal Cancer, Ann. Otol. Rhin. & Laryng. **60**:168-174 (March) 1951.

39. Kerwin, R. W.: Juvenile Nasopharyngeal Angiofibroma, A. M. A. Arch. Otolaryng. **53**:397-405 (April) 1951.

40. Kernan, J. D.: The Pathology of Carcinoma of the Larynx Studied in Serial Sections, Tr. Am. Acad. Ophth. **55**:10-21 (Sept.-Oct.) 1950.

41. Kaplan, S.: Cancer of the Larynx Classified in 3 Dimensions: An Aid in Management, Arch. Otolaryng. **51**:696-698 (May) 1950.

2. Intrinsic penetrating (does not respond to irradiation): The neoplasm in this group has invaded the muscular tissue, and the vocal cord is either partly or entirely fixed.

3. Extrinsic superficial (best treated by irradiation): Such a neoplasm, like the intrinsic type, originates in the larynx but has overgrown, or spilled over, the rim. It has not involved the musculature, as evidenced by mobility of the vocal cords.

4. Extrinsic penetrating (should be treated surgically): The neoplasm so classified is similar in every way to the extrinsic superficial type, but the cells have involved the muscle, and there is partial or total fixation of the vocal cords.

5. Extrinsic hypopharyngeal (poor results with any form of treatment): The neoplasm in this class originates in epithelium without a basement membrane. It is found on the epiglottis, aryepiglottic folds, arytenoid cartilages, postcricoid regions, and pyriform sinuses.

LeJeune [42] states that intrinsic cancer of the vocal cords if treated sufficiently early in its course responds successfully to removal by use of either intralaryngeal operation or laryngofissure. Both of these operations are considered to be conservative surgical procedures by which a potentially fatal disease can be eradicated. These operations provide a rate of cure of approximately 93 and 85%, respectively, and vocal function, though damaged, is well preserved.

Orton [43] considers that the indications for laryngectomy are as follows: 1. The growth has extended to the anterior commissure or has extended backward to the arytenoid cartilage. 2. The epiglottis is involved below the level of the hypoglottic ligament. 3. The growth has crossed to the opposite side, and there is subglottic extension. 4. The growth springs from the ventricle or ventricular fold. 5. The growth has involved the thyroid cartilage or cricothyroid membrane. 6. The growth is extrinsic. 7. Definite fixation of one or both vocal cords is present. 8. The growth is subglottic in origin. 9. Recurrence following laryngofissure is present. 10. The larynx has been subjected to unsuccessful irradiation (in selected cases).

Del Regato [44] states that the accomplishments of radiotherapy in the entire group of hypopharyngeal and pharyngolaryngeal carcinomas have been rather poor. X-ray therapy is the treatment of choice for supraglottic carcinomas. Radical surgical removal is the treatment of choice for subglottic carcinomas. Carcinomas of the vocal cords that are accompanied by edema or fixation of the larynx are controlled infrequently by x-ray therapy and are best treated by laryngectomy. Del Regato is of the opinion that when radiotherapy has been adequately performed patients with recurrent lesions may receive the additional full benefit of a total laryngectomy without hindrance. The dose of x-rays that is administered is not the amount necessary to destroy the tumor but rather the maximal permissible dose that may be given with safety to normal structures in the circumstances of the treatment.

42. LeJeune, F. E.: The Surgical Treatment of Early Carcinoma of the Larynx, Laryngoscope **61**:488-495 (June) 1951.

43. Orton, H. B.: Treatment of Extensive Carcinoma of the Larynx, Laryngoscope **61**: 496-510 (June) 1951.

44. del Regato, J. A.: Roentgen Therapy of Carcinoma of the Endolarynx, Laryngoscope **61**:511-516 (June) 1951.

Nielsen [45] considers that surgical removal currently is to be preferred to radiation therapy when there is subglottic cancer or when the vocal cords are fixed. The main objections to irradiation of cancer of the larynx are that it requires a longer time than does operation and that it is more complicated and difficult to use.

Schulz [46] is of the opinion that supervoltage x-ray therapy has become an established procedure in the treatment of cancer about the mouth and throat. Its clinical advantages in these regions are probably not manifest to the same degree as in those parts where the tumor is deeper. The over-all results, so far as eradication of the disease is concerned, have not been notably improved by the use of supervoltage x-ray therapy, but the facility with which it can be done has been increased, and the damage to the patient while the destruction of the tumor is being accomplished has been lessened.

Baclesse [47] found that 21% of patients with cancer of the larynx who received x-ray therapy were cured for five years or more. He states that it is impossible to overemphasize the importance of the quality of the x-ray treatment. From the practical point of view, it might be advisable to recall the old maxim that, "a good surgeon is worth more than a bad radiotherapist." The newer techniques for surgical procedures on the larynx present practical advantages over radiotherapy, unless radiotherapy is carried out under those irreproachable conditions that demand a long specialized training.

Negus,[48] in a discussion of the choice of treatment for carcinoma of the larynx, states that in any comparison only treatment given by highly skilled persons should be considered, both as regards the surgeon and as regards the radiotherapist. A misguided or unskilled surgeon or radiotherapist can do great damage, considering both immediate and future results. Considerable difficulty in forming conclusions is encountered, since radiotherapy is a changing therapeutic method. Dosage of interstitial irradiation has undergone many changes; the voltage used for x-ray therapy has varied from time to time and from one clinic to another, and the quantity of radiation used for teleradium treatment has also varied considerably.

Negus is of the opinion that the prognosis is about equal as between operation and radiotherapy for patients who have limited lesions. When the lesions are advanced and widespread, the advantage lies with radical operation. He sees no need for narrow-field laryngectomy and recommends removal of the hyoid bone, preepiglottic space, and three or more rings of the trachea.

Concerning preservation of function, no doubt exists that radiotherapy, if it succeeds, offers the best prospects, as the voice may remain almost normal or even completely so. Recurrence after limited operation allows laryngectomy to be performed. If growth recurs after treatment by x-ray or teleradium administration, further radiotherapy will be ineffective. Laryngectomy performed after radiotherapy is more difficult, and breaking down of the wound is likely to occur. Negus states

45. Nielsen, J.: Functional Results and Permanence of Cure Following Roentgentherapy of Intralaryngeal Carcinomas, J. Fac. Radiologists **3**:29-34 (July) 1951.

46. Schulz, M. D.: Supervoltage Roentgen Therapy in Cancer of the Mouth and Throat, Radiology **55**:52-59 (July) 1950.

47. Baclesse, F.: Roentgentherapy of Carcinoma of the Larynx, J. Fac. Radiologists **3**:3-12 (July) 1951.

48. Negus, V. E.: Radiotherapy in Cancer of the Larynx: Observations on the Choice of Treatment, J. Fac. Radiologists **3**:13-19 (July) 1951.

that, with careful attention to detail, the danger to life in any method of treatment can be ignored. It is his opinion that in comparable cases the failures of radiotherapy entail greater suffering than those failures that follow operation. If an operation fails, the malignant growth will at its worst continue unchecked, but, if irradiation fails, the growth is slowed, with prolongation of life and, in his experience, aggravation of suffering.

Kemler [49] describes a new conservative operation for cancer of the larynx. Bilateral thyrotomy is recommended for the removal of any cancer of the larynx that requires laryngofissure. In many cases this procedure can replace laryngectomy. The anterior commissure, with the overlying cartilage and the cricothyroid membrane, always is removed.

Rudo and Jones [50] present 10 cases of pulmonary tuberculosis that occurred in a group of 122 patients, 79 of whom had laryngeal cancer and 43 of whom had tracheotomies. Whether there is a relationship between tracheotomy or laryngeal carcinoma and the activation of a pulmonary tuberculosis process is a controversial subject. It is the opinion of these workers that tracheotomy or laryngeal cancer in some patients apparently awakened pulmonary tuberculosis that was either of the inactive type or of the primary complex type. In other patients, radiation therapy for laryngeal cancer apparently deleteriously affected active pulmonary tuberculosis. It is recommended that patients with laryngeal cancer be watched closely for signs of pulmonary tuberculosis before and after they receive such treatment.

Mumma and Pressman [51] describe a surgical procedure in which rings of cobalt-chromium alloy (vitallium®) are implanted in an attempt to keep the tracheal stoma patent in laryngectomized patients, thus obviating use of the tracheal tube.

Lachmann [52] reports two cases of sarcoma of the larynx. It is estimated that the ratio of sarcomas to all other malignant tumors of the larynx is 1 to 95.

Holinger and Johnston [53] present a statistical analysis of the records of a series of 1,197 cases of benign tumor of the larynx. Ninety-seven per cent of the lesions were on the true vocal cords, and 26% were bilateral. The incidence of benign tumors in men far exceeded that in women except for the occurrence of nodules on the vocal cords and hematomas which were twice as frequent in females.

Treatment in the great majority of cases consisted of removal of the lesion with forceps with the use of local anesthesia. When the lesions were bilateral and involved the anterior commissure, only one side was treated at a time.

According to Stark and New,[54] focal deposits of amyloid may occur in many parts of the body, but the commonest sites are the larynx and trachea. Amyloid

49. Kemler, J. I.: Bilateral Thyrotomy for Carcinoma of the Larynx, New England J. Med. **244**:275-281 (Feb. 22) 1951.

50. Rudo, A. D., and Jones, D. H.: The Relation of Tracheotomy and Laryngeal Carcinoma to Pulmonary Tuberculosis, Ann. Otol. Rhin. & Laryng. **59**:931-942 (Dec.) 1950.

51. Mumma, C. S., and Pressman, J. J.: A Surgical Technic to Eliminate the Tracheotomy Tube After Laryngectomy, Tr. Am. Acad. Ophth. **55**:418-423 (March-April) 1951.

52. Lachmann, J.: Sarcoma of the Larynx, A. M. A. Arch. Otolaryng. **53**:299-307 (March) 1951.

53. Holinger, P. H., and Johnston, K. C.: Benign Tumors of the Larynx, Ann. Otol. Rhin. & Laryng. **60**:496-509 (June) 1951.

54. Stark, D. B., and New, G. B.: Amyloid Tumors of the Larynx and Trachea, M. Clin. North America **34**:1145-1150 (July) 1950.

disease occurs most commonly in the fifth, sixth, and seventh decades. Involvement may be localized or diffuse. The surface may be smooth or nodular, and a definite yellow appearance has been noted. Expectant treatment apparently is advisable in cases in which the larynx is involved by proved amyloid disease and in which the process is diffuse but is of such a size and location as to produce only hoarseness and not dyspnea. Surgical treatment may include skin grafting to cover extensive denuded surfaces. If the size of the lesion increases until dyspnea is produced, then radical removal is indicated.

Cordray and Gervais [55] report a case of lymphangioma of the larynx. They were able to find but six cases on record.

Kelly [56] reports a case of chondroma of the vocal cord. Only one other case of chondroma confined to the vocal cords is recorded in the literature. The total number of cases of laryngeal chondroma reported in the literature is 90. The usual type of chondroma encountered in the larynx is the enchondroma, arsing from one of the cartilages. The favorite point of origin is the endolaryngeal surface of the posterior plate of the cricoid. The thyroid, epiglottic, and arytenoid cartilages come next in order of frequency.

Lipomas of the larynx are tumors of considerable rarity, as is shown by the fact that in 1934 a review of the literature uncovered the records of only 47 cases. According to Maconie,[57] most laryngeal lipomas originate in extrinsic structures, and many are pedicled and grow to a large size before they are removed. He reports a case in which a lipoma originated on the left aryepiglottic fold in a 45-year-old man.

Costen [58] adds a case of plasmacytoma of the epiglottis and pharyngeal wall. A large focus of myeloma was present within the tibia.

Buffmire, Clagett, and McDonald [59] report a case in which papillomas occurred simultaneously in the larynx, trachea, and bronchi. It is believed that this is an example of multicentric origin of tumors. The patient had received intermittent treatment (including irradiation) since 1925 for papillomas of the larynx. In 1948, biopsy revealed squamous-cell carcinoma in the larynx. Palpable cervical lymph nodes appeared, and a lesion in the thorax that proved to be a papillary squamous-cell carcinoma was removed surgically. It is thought that the lesions in this case are similar to papillary tumors in the urinary tract.

Blassingame and Jones [60] report a case in which papillomas of the larynx, trachea, bronchi, and lungs occurred in a 14-month-old girl. The significant pathologic changes were limited to the airway and lungs. Innumerable papillomas were noted in the epiglottis, larynx, trachea, and bronchi. Great irregularity of the

55. Cordray, D. P., and Gervais, R. F.: Lymphangioma of the Larynx, A. M. A. Arch. Otolaryng. **53**:83-86 (Jan.) 1951.

56. Kelly, D. B.: Chondroma of the Vocal Cord, J. Laryng. & Otol. **64**: 195-197 (April) 1950.

57. Maconie, A. C.: Lipoma of the Larynx, J. Laryng. & Otol. **65**:426-433 (June) 1951.

58. Costen, J. B.: Plasmacytoma: A Case with Original Lesion on the Epiglottis and Metastasis to the Tibia, Laryngoscope **61**:266-270 (March) 1951.

59. Buffmire, D. K.; Clagett, O. T., and McDonald, J. R.: Papillomas of the Larynx, Trachea and Bronchi: Report of Case, Proc. Staff Meet., Mayo Clin. **25**:595-600 (Oct. 11) 1950.

60. Blassingame, C. D., and Jones, R.: The John Gaston Hospital Clinical Pathological Conference, Memphis July 10, 1950, J. Tennessee M. A. **43**:286-289 (Aug.) 1950.

tracheal mucosa was present between the large and the small papillomas. This irregularity suggests that there are many gradations of mucosal changes and many stages of papillomatous transformation. The most unusual aspect of this case was the occurrence of papillomas in the pulmonary tissue. These lesions were in the bronchi, bronchioles, and even the alveoli. It was believed that all the respiratory epithelium, even the alveolar-lining cells, responded to the papilloma-producing agent. Blassingame and Jones state that pedunculated laryngeal papillomas in children should be removed and the procedure repeated as long as these tumors recur in the pedunculated form. When the papillomas are broad and flat, it is best to perform a tracheotomy and to keep the tracheotomy tube in place for an indefinite period, giving the tumor an opportunity to involute and disappear.

Holinger, Novak, and Johnston [61] report on 28 cases of tracheal tumor. Eighteen of the tumors were primary in the trachea, and 10 involved the trachea from adjacent structures to produce signs, symptoms, and endoscopic findings similar to those seen in primary tracheal tumors. Five of the tumors were the result of inflammation, and 23 were neoplastic, of which 5 were benign and 18 malignant. Wheezing frequently was so manifestly expiratory and bilateral in character that most patients had undergone extensive surveys and treatment for asthma. Hemoptysis was a constant finding in the cases of malignant tracheal tumor. The primary step in the treatment is to establish the airway.

Straus and Guckien [62] report a case of schwannoma in which the tumor was polypoid in character and was attached at the orifice of the left main bronchus, causing partial obstruction of that bronchus.

McKenzie [63] reports two cases of carcinoma of the trachea. They were the only such cases found in a study of 19,700 necropsy reports at McGill University and Montreal General Hospital. Until 1945, only 507 cases of tumor of the trachea had been recorded, and of these there were only 187 cases of carcinoma. Stridor is the most obvious physical sign, and sudden intense dyspnea may occur when the trachea is palpated. Guttman, Simon, and Nitka [64] also report a case of primary carcinoma of the trachea.

TUMORS OF THE HYPOPHARYNX AND ESOPHAGUS

Friedberg,[65] in a discussion of esophagoscopy in the diagnosis and treatment of esophageal disease, states that the symptoms of such disease may be difficult swallowing, substernal distress, hematemesis, and loss of weight. Before esophagoscopy is done, the patient should have an examination of the nose and throat, and roentgenograms of the thorax should be taken. Rarely should the fluoroscopic study of the passage of an opaque medium in the patient be omitted. The procedures

61. Holinger, P. H.; Novak, F. J., and Johnston, K. C.: Tumors of the Trachea, Laryngoscope **60**:1086-1109 (Nov.) 1950.

62. Straus, G. D., and Guckien, J. L.: Schwannoma of the Tracheobronchial Tree: A Case Report, Ann. Otol. Rhin. & Laryng. **60**:242-246 (March) 1951.

63. McKenzie, W.: Two Cases of Carcinoma of the Trachea, J. Laryng. & Otol. **64**:431-433 (July) 1950.

64. Guttman, M. R.; Simon, M. U., and Nitka, C. B.: Primary Carcinoma of the Trachea, Arch. Otolaryng. **52**:172-176 (Aug.) 1956.

65. Friedberg, S. A.: Esophagoscopy in the Diagnosis and Treatment of Esophageal Disease, S. Clin. North America **31**:3-19 (Feb.) 1951.

of bouginage and probing when conducted blindly are to be condemned strongly. Esophagoscopy is contraindicated in patients with severe cardiac disturbance or aortic aneurysm.

If esophagoscopy is contemplated for a seriously ill patient, the importance of the information likely to be gained thereby must be evaluated critically. General anesthesia is rarely indicated but need not be withheld if necessary for safe esophagoscopy.

Watson and Brown [66] present four cases of carcinoma of the esophagus, all proved by biopsy and treated by multifield beam-directed x-ray therapy. Studies at necropsy in these cases revealed no residual tumor in the espohagus or nearby tissue. Radiotherapy of this disease has been abandoned in many centers in favor of operation, or at least it has been relegated to a place of secondary importance because of the recent technical improvements in thoracic operations and the advent of antibiotics. This report attempts to show that, at least in the primary site, cancer of the esophagus can be eradicated with properly planned x-ray therapy and that such treatment allows restoration to an almost normally functioning esophagus.

Timmons and Timmons [67] state that whenever a nodule is found in the hypopharynx or the posterior aspect of the tongue, the following questions are to be answered: 1. Is this nodule produced by aberrant thyroid tissue? 2. Is there any thyroid tissue present in its normal pretracheal location? 3. Are the symptoms sufficient to warrant excision of the lingual nodule?

Hypothyroidism has followed excision of the lingual nodule of thyroid tissue in 65 to 70% of the cases reported. Palpation of the normal thyroid gland in the neck frequently is difficult and may well give rise to erroneous conclusions on the part of the examining physician. Routine surgical exploration of the neck has been advised to verify the existence of thyroid tissue before surgical removal of the lingual thyroid is attempted. The high incidence of postoperative hypothyroidism naturally compels the surgeon to refrain from intervention until local symptoms are sufficiently severe to warrant the complications associated with excision of the lingual thyroid. Use of radioactive iodine in conjunction with the Geiger-Müller counter and studies of urinary excretion makes it possible to localize the thyroid tissue and its aberrations and also to determine the degree of normality or abnormality of this tissue in the living body. Timmons and Timmons report two cases in which studies with the use of tracers of iodine were done. They include a brief survey of the literature regarding lingual nodules of thyroid tissue.

Lampe [68] states that properly executed radiation treatment produces good results in the eradication of the primary tumor in carcinomas of the oral part of the tongue, but cancer of the pharyngeal part of the tongue differs in many respects from the growths found in the oral part of this organ, and the prognosis is less favorable. With rare exceptions, tonsillar malignant lesions are solely radiotherapeutic problems, with respect to treatment of both the primary site and the sites

66. Watson, T. A., and Brown, E. M.: X-Ray Therapy in Carcinoma of the Esophagus, J. Thoracic Surg. **22**:216-218 (Aug.) 1951.

67. Timmons, J. R., and Timmons, J. M.: Lingual Thyroid: The Use of Radioactive Iodine in Diagnosis, Ann. Surg. **133**:90-94 (Jan.) 1951.

68. Lampe, I.: Malignant Neoplasms of the Tongue, Tonsil and Hypopharynx: Evaluation of Radiation Therapy, Tr. Am. Acad. Ophth. **55**:231-236 (Jan.-Feb.) 1951.

of metastasis in the neck. The results of radiotherapy for carcinoma of the pyriform sinus and the postcricoid region to date have been poor. The prognosis for patients with lesions of the vallecula and pharyngoepiglottic fold is much better.

Orton [69] states that surgical operation in cases of malignant neoplasms of the tongue, tonsil, and hypopharynx is the most useful and trustworthy means of treatment. The gravity of the prognosis increases successively when the lesion is in the following locations: the epiglottis, the arytenoid cartilages, the aryepiglottic fold, the pyriform sinus, and the postcricoid region.

Jacobsson [70] reports a clinical study of 322 cases of carcinoma of the hypopharynx. He describes a method of x-ray treatment utilizing direction of beams by means of fluoroscopy. The term "hypopharyngeal cancer" is used to include all carcinomas from the valleculae to the upper part of the esophagus, with the exception of intrinsic laryngeal carcinomas. The borderline between the larynx and the hypopharynx is drawn at the laryngeal inlet, that is, the edge of the epiglottis, the aryepiglottic folds, and the arytenoid region. Jacobsson classifies cancer of the hypopharynx into two groups, namely, carcinoma of the upper part and carcinoma of the lower part. The borderline for the division is drawn at the superior border of the cricoid cartilage. The first group includes carcinomas situated in the external portions of the larynx and the pyriform fossa. In patients in Sweden, 75% of carcinomas of the hypopharynx occur in the lower part. In Jacobsson's study, 90% of the women and 10% of the men had the Plummer-Vinson syndrome. Metastasis to the cervical lymph nodes was present in 54% of these patients. Well-differentiated squamous-cell carcinoma was the predominant morphologic type. Poorly differentiated carcinomas were found in a third of the lesions originating in the upper part of the hypopharynx but in only a tenth of the lesions originating in the lower part. In Jacobsson's series, about 10% of the patients who had carcinoma of the upper part of the hypopharynx and who were treated by a fractionated method of x-ray therapy were cured for five years or more. When the carcinoma was in the lower part of the hypopharynx, about 17% of the patients were cured for five years or more.

Carcinoma of the esophagus accounts for approximately 4% of all deaths from malignant disease, and from 18 to 25% of such tumors arise in the cervical portions of the esophagus or gullet, according to Coleman and Brawner.[71] Swelling of the neck caused by metastasis to cervical lymph nodes may be the first complaint. Halitosis and roughness or "sticking" in the throat on swallowing usually precede dysphagia. Persistent pain in the ear or hoarseness is very common. Direct examination of the lesion usually is necessary to make the diagnosis.

Coleman and Brawner [71] state that carcinoma of the cervical portion of the esophagus should be treated by one of three surgical methods. The first consists of block resection of the cervical portion of the esophagus, laryngopharynx, larynx, and trachea, together with hemithyroidectomy and unilateral radical dissection of

69. Orton, H. B.: Malignant Neoplasms of the Tongue, Tonsils and Hypopharynx: Evaluation of Surgical Treatment, Tr. Am. Acad. Ophth. **55**:226-230 (Jan.-Feb.) 1951.

70. Jacobsson, F.: Carcinoma of the Hypopharynx: A Clinical Study of 322 Cases, Treated at Radiumhemmet, from 1939 to 1947, Acta radiol. **35**:1-21 (Jan.) 1951.

71. Coleman, F. P., and Brawner, D. L.: Carcinoma of the Cervical Esophagus, A. M. A. Arch. Surg. **62**:102-111 (Jan.) 1951.

the neck with removal of the contralateral nodes along the jugular vein. This method also includes reconstruction of the esophagus with a tube lined with skin. The experience of these authors in the treatment of cancer of the cervical portion of the esophagus has been confined primarily to cases in which the Wookey type of operation is suitable. The second method includes segmental resection of the cervical portion of the esophagus and the regional lymphatic vessels and nodes, together with restoration of the esophagus by use of a tube lined with skin. The third method consists of cervicothoracic resection of the esophagus with pharyngogastric or cervical esophagogastric anastomosis.

Baronofsky and Hilger [72] present a case of cervical esophageal carcinoma in which resection of the esophagus and larynx was performed. A tube of tantalum mesh covered on the outside by fascia lata was inserted in the esophageal gap.

Klopp, Alford, and Pierpont [73] state that a limiting factor in surgical procedures on the pharynx, larynx, and upper two thirds of the cervical part of the esophagus has been the difficulties encountered in reconstruction of the gullet. They present a method for reconstruction of the pharynx and cervical portion of the esophagus in dogs. By use of polyethylene film and a split-thickness skin graft, it is possible to reconstruct the cervical portion of the esophagus in one stage at the time of excision.

Maino and Seybold [74] present two cases of carcinoma of the upper thoracic and cervical portions of the esophagus in which the patients were treated by one-stage esophagectomy and cervical esophagogastrostomy.

An angioendothelioma, a rare tumor, is described by Palanker, Constantine, and Paine.[75] It was situated in the cervical portion of the esophagus and was removed by radical operation, in which the defect was reconstructed by use of a Wookey flap. Only four other such cases have been reported.

Carrie [76] reports a case of adenocarcinoma of the upper end of the esophagus arising from ectopic gastric epithelium. To the best of his knowledge, this is the second such case recorded in the literature. Nearly the entire esophagus is lined by stratified squamous epithelium. However, two types of glands may be found in it. A few irregularly distributed submucosal mucus-secreting glands are present always, and often some superficial ones resembling gastric glands are situated in the mucosa at the upper and the lower ends of the esophagus. Such glands in the lower end are common. Those located in the upper end occur in isolated islands of ectopic gastric mucosa on the lateral walls of the esophagus between the level of the cricoid cartilage and the fifth tracheal ring and are present in about half of the specimens examined.

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72. Baronofsky, I. D., and Hilger, J.: Fascia Lata Transplants for Resected Cervical Esophagus, Surgery **30**:355-360 (Aug.) 1951.

73. Klopp, C. T.; Alford, C., and Pierpont, H.: The Use of Polyethylene Film and Split-Thickness Skin Graft in Reconstruction of Cervical, Esophageal, and Pharyngeal Defects, Surgery **29**:231-239 (Feb.) 1951.

74. Maino, V. J., and Seybold, W. D.: Carcinoma of the Upper Thoracic and Cervical Portions of the Esophagus Treated by One-Stage Esophagectomy and Cervical Esophagogastrostomy: Report of 2 Cases, Proc. Staff Meet., Mayo Clin. **25**:505-512 (Aug. 30) 1950.

75. Palanker, H. K.; Constantine, A. B., and Paine, J. R.: Successful Resection of an Angioendothelioma of the Cervical Esophagus: Case Report and Review of the Literature, A. M. A. Arch. Surg. **62**:627-633 (May) 1951.

76. Carrie, A.: Adenocarcinoma of the Upper End of the Oesophagus Arising from Ectopic Gastric Epithelium, Brit. J. Surg. **37**:474 (April) 1950.

Warfield [77] reports a case of carcinosarcoma of the esophagus discovered at necropsy. Ninety per cent of malignant tumors of the esophagus are squamous-cell carcinomas, and 10% are adenocarcinomas. Sarcomas are rare. Carcinosarcomas are even rarer. No unanimity of opinion occurs as to the existence of such an entity. Many of these dual tumors are thought to be examples of extreme variations of carcinomatous cells.

Lyons and Garlock [78] report the first successful resection of a leiomyosarcoma of the esophagus. In 1931, less than 50 cases of primary sarcoma of the esophagus had been recorded. Approximately 20 of the primary sarcomas have arisen from muscle cells, and the great majority of these have been rhabdomyosarcomas. Only six cases of leiomyosarcoma of the esophagus have been reported, in one of which the lesion was removed. Two general varieties of leiomyosarcoma of the esophagus exist: (1) the polypoid localized neoplasm without metastasis and (2) the invasive neoplasm infiltrating the esophageal wall, growing in large part extrinsically and sometimes metastasizing to the regional lymph nodes.

Thorek and Neiman [79] report the first successful resection of a rhabdomyosarcoma of the esophagus. They also review the literature.

Myers and Bradshaw,[80] Garlick and Stegmaier,[81] and Dugan and Meagher [82] discuss the benign intramural tumors of the esophagus.

TUMORS OF THE EAR AND MASTOID

Ward, Loch, and Lawrence [83] state that squamous-cell carcinoma is the commonest type of malignant tumor occurring in the region of the external auditory canal and surrounding structures. In general, the problem is essentially that of squamous-cell carcinoma invading bone, adjacent soft tissues, and cervical lymph nodes. They are of the opinion that the usual radical mastoidectomy followed by supplementary irradiation is unsatisfactory treatment because it does not attack adequately the cervical metastasis, the primary site, and the local extension into the soft tissues. The cervical nodes were involved with carcinoma in their five cases.

These workers emphasize the necessity for cervical dissection and state that it should be done in continuity with removal of the primary lesion. The procedure adhered to in the cervical portion of the operation is the usual classic cervical dissection. The posterosuperior part of the dissection is the most difficult, and the technique used in this location varies somewhat with the extent of the tumor. The parotid gland, facial nerve, preauricular skin, pinna, mastoid, and parts of the tem-

77. Warfield, C. I.: Carcinosarcoma of the Esophagus, Bull. Georgetown Univ. M. Center **4**:71-75 (Oct.-Nov.) 1950.

78. Lyons, A. S., and Garlock, J. H.: Leiomyosarcoma of the Esophagus: Report of First Successful Resection, Surgery **29**:281-287 (Feb.) 1951.

79. Thorek, P., and Neiman, B. H.: Rhabdomyosarcoma of the Esophagus, J. Thoracic Surg. **20**:77-89 (July) 1950.

80. Myers, R. T., and Bradshaw, H. H.: Benign Intramural Tumors and Cysts of the Esophagus, J. Thoracic Surg. **21**:470-482 (May) 1951.

81. Garlick, W. L., and Stegmaier, J. G.: Benign Tumors of the Esophagus: Report of a Case of Leiomyoma, Surgery **29**:109-116 (Jan.) 1951.

82. Dugan, D. J., and Meagher, T.: Esophageal Leiomyomas: Report of Additional Case, Arch. Surg. **61**:1066-1072 (Dec.) 1950.

83. Ward, G. E.; Loch, W. E., and Lawrence, W., Jr.: Radical Operation for Carcinoma of the External Auditory Canal and Middle Ear, Am. J. Surg. **82**:169-178 (July) 1951.

poral bone may have to be removed. In some instances, the condyle of the mandible and the zygoma may have to be removed with the tumor. The lateral sinus, the jugular bulb, and the dura mater are uncovered always, and frequently the carotid artery is unroofed. It is imperative to follow the operation in all cases with irradiation therapy. In all but one case the portion of the wound overlying the excavation of bone was packed open. After x-ray therapy to the open wound, it is closed with some type of skin graft.

Mark and Rothberg [84] report a case of mixed tumor in the external auditory canal in a 29-year-old woman. Hitherto, the ear has been reported only once as the site of a mixed tumor, and in that instance the tumor was on the pinna.

Von Leden [85] reports a case of recurring extensive myxofibrosarcoma of the external auditory canal in a 13-year-old boy. It was excised, and the wound was covered by a skin graft, but the tumor recurred.

Love [86] reports a case of neurofibroma, completely enclosed within the petrous bone, that resulted in unilateral deafness and progressive facial palsy. Although deafness and facial paralysis are encountered rather frequently and deafness caused by an intracranial tumor is not uncommon, deafness with progressive facial palsy without cerebellar signs is extremely rare.

Kettel [87] reports a case of neurogenic sarcoma arising from the descending part of the facial nerve that destroyed the posterior osseous wall of the fallopian canal and expanded into the deeper mastoid cells.

Tamari, McMahon, and Bergendahl [88] describe and illustrate the site of origin of glomus jugulare tumors. They presented two cases of mesenchymal tumor of the middle ear, in one of which the classic features of a glomus jugulare tumor were present. In the other, the difficulties of the histopathologic classification of some of the mesenchymal tumors originating in the middle ear were revealed. These difficulties are twofold: 1. Theoretically, any tumor arising from the glomus jugulare may show a marked dedifferentiation leading to the picture of a sarcomatous tumor. 2. A mesenchymal tumor originating outside the glomus jugulare may differentiate into a fibrosarcoma or a hemangioendothelioma, and parts of these tumors may present the features of a perithelioma.

Dockerty, Love, and Patton [89] report a case of nonchromaffin paraganglioma in which the growth, originally situated in the middle ear, burst through its bony confines and produced clinical symptoms suggestive of an intracranial neoplasm. For a number of years it has been common knowledge that there exist in the neck,

84. Mark, I., and Rothberg, M.: Mixed Tumor of Skin of External Auditory Canal, A. M. A. Arch. Otolaryng. **53**:556-559 (May) 1951.

85. Von Leden, H.: Myxofibrosarcoma of the External Auditory Canal, Ann. Otol. Rhin. & Laryng. **60**:258-259 (March) 1951.

86. Love, J. G.: Unilateral Deafness and Progressive Facial Palsy Due to Intrapetrous Neurofibroma: Surgical Treatment, Proc. Staff Meet., Mayo Clin. **25**:228-232 (April 26) 1950.

87. Kettel, K.: Intratemporal Sarcoma of the Facial Nerve, Arch. Otolaryng. **52**:778-781 (Nov.) 1950.

88. Tamari, M. J.; McMahon, R. J., and Bergendahl, E. H.: Carotid Body-Like Tumors of the Temporal Bone, with Particular Reference to Glomus-Jugulare Tumors, Ann. Otol. Rhin. & Laryng. **60**:350-364 (June) 1951.

89. Dockerty, M. B.; Love, J. G., and Patton, M. M.: Nonchromaffin Paraganglioma of the Middle Ear: Report of a Case in Which the Clinical Aspects Were Those of a Brain Tumor, Proc. Staff Meet., Mayo Clin. **26**:25-32 (Jan. 17) 1951.

mediastinum, and abdomen certain "paraganglionic" structures bearing a strong histologic resemblance to the well-known glomus caroticum, or carotid body. It is apparent now that many so-called angiomatous polyps and hemangioendotheliomas of the middle ear were in reality examples of glomus jugulare tumor. This tumor has been called "nonchromaffin paraganglioma" of the middle ear. The tumors rarely metastasize, but their vascular component is so prominent that severe and at times fatal hemorrhage may result from their attempted removal.

According to Weille and Lane,[90] the surgical problems in dealing with glomus jugulare tumors are chiefly the risk of hemorrhage, recurrence, possible metastasis, danger of facial paralysis from local invasion or surgical trauma, and inability to employ conventional anatomic landmarks in the operation. They recommend the following treatment: 1. Radical mastoidectomy or labyrinthotomy or both are done. Ligation of the external carotid artery and internal jugular vein may be necessary. 2. Routine postoperative irradiation is employed. These workers attempted to remove bone until the mass was exposed widely, avoiding direct trauma to the neoplasm. Rapid dissection was then done, with removal of all gross tumor. They present three cases of glomus jugulare tumor. One tumor presented simultaneously in both the ear and the nasopharynx.

Volk[91] states that all cholesteatomas occur in the temporal bone or tympanum as actual primary tumors and are caused by the inclusion during embryonic life of fetal epidermoid cells.

Begley, McDonald, and Williams[92] state that an aural cholesteatoma is composed of a lining of vascular and connective tissue that supports a layer of squamous epithelium that, in turn, desquamates into the center of the mass. The theories of origin of aural cholesteatomas are the primary, or neoplastic, theory, the ingrowth theory (theory of immigration), and the metaplastic theory. They conclude that it is possible for an aural cholesteatoma to originate in the manner indicated by any of these theories. However, the metaplastic theory of origin appears to be the most plausible in the majority of cases.

In another report, Begley and Williams[93] record two cases of external cholesteatomatous cysts of the mastoid that developed subsequent to radical operation for the removal of aural cholesteatomas. It is postulated that these lesions develop from remaining cholesteatomatous matrices. Thorough removal of the cholesteatomatous matrix is advocated in the surgical treatment of oral cholesteatomas.

90. Weille, F. L., and Lane, C. S., Jr.: Surgical Problems Involved in the Removal of Glomus-Jugulare Tumors, Laryngoscope **61**:448-459 (May) 1951.

91. Volk, B. M.: Primary Aural Cholesteatoma, A. M. A. Arch Otolaryng. **53**:662-667 (June) 1951.

92. Begley, J. W., Jr.; McDonald, J. R., and Williams, H. L.: Histology and Histogenesis of Cholesteatoma of the Middle Ear and Mastoid, A. M. A. Arch. Otolaryng. **53**:41-52 (Jan.) 1951.

93. Begley, J. W., Jr., and Williams, H. L.: Cholesteatomatous Cysts Secondary to Incomplete Removal of the Cholesteatomatous Matrix, A. M. A. Arch. Otolaryng. **53**:147-152 (Feb.) 1951.

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Audiotone Model 11
Mfr., Audio Company of America
5305 N. Sixth St.
Phoenix, Ariz.

Audivox Model Super 67
Mfr., Audivox, Inc.—Successor to Western Electric Hearing Aid Division
123 Worcester St.
Boston 18

Aurex Models L & M
Mfr., Aurex Corporation
1117 N. Franklin St.
Chicago 10

Beltone Symphonette Model

Beltone Mono-Pac Model M
Mfr., Beltone Hearing Aid Co.
1450 W. 19th St.
Chicago 8

Cleartone Models 500 & 700

Cleartone Regency Model
Mfr., American Sound Products, Inc.
1303 S. Michigan Ave.
Chicago 5

Dahlberg Model D-1

Dahlberg Junior Model D-2

Dahlberg Model D-3

Dahlberg Model D-4
Mfr., The Dahlberg Company
Golden Valley
Minneapolis 22

Dysonic Model 1
Mfr., Dynamic Hearing Aids, Inc.
149 Church St.
New York 7

Electroear Model C
Mfr., American Earphone Co., Inc.
10 E. 43rd St.
New York 17

Gem Models V-35 & 60
Mfr., The Gem Ear Phone Co., Inc.
50 W. 29th St.
New York 1

Goldentone Models 25, 69 & 97
Mfr., Johnston Hearing Aid Mfg. Co.
708 W. 40th St.
Minneapolis 8

Distr., Goldentone Corporation
708 W. 40th St.
Minneapolis 8

Maico UE Atomeer

Maico Quiet Ear Models G & H

Maico Model J
Mfr., The Maico Company, Inc.
21 N. 3rd St.
Minneapolis 1

Mears (Crystal & Magnetic) Aurophone Model 200

1947-Mears Aurophone Model 98
Mfr., Mears Radio Hearing Device Corporation
1 W. 34th St.
New York 1

Micronic Model 303

Micronic Model Mercury

Micronic Star Model
Mfr., Audivox, Inc.—Successor to Western Electric Hearing Aid Division
123 Worcester St.
Boston 18

Microtone Audiomatic T-5

Microtone Classic Model T-9

Microtone Models T-10, T-612 & 45
Mfr., The Microtone Company
Ford Parkway on the Mississippi
St. Paul 1

National Cub Model (C)

National Model D (Duplex)

National Standard Model (T)

National Star Model (S)

National Ultrathin Model 504

National Vanity Model 506
Mfr., National Hearing Aid Laboratories
106 S. 7th St.
Philadelphia 6

Normatone Model C
Mfr., Johnston Hearing Aid Mfg. Co.
708 W. 40th St.
Minneapolis 8
Distr. Normatone Hearing Aid Co.

Otarion Model E-4

Otarion Models F-1, F-2 & F-3

Otarion Models G-2 & G-3
Mfr., Otarion, Inc.
4757 N. Ravenswood Ave.
Chicago 40

Paravox Model D Top-Twin-Tone

Paravox Model J (Tiny-Myte)

Paravox Model XTS ('Xtra-Thin)

Paravox Model Y (YM, YC & YC-7) (Veri-Small)
Mfr., Paravox, Inc.
2056 E. 4th St.
Cleveland 15

Radioear Permo-Magnetic (Multipower)

Radioear Permo-Magnetic (Uniphone)

Radioear All-Magnetic Model 55

Radioear Model 62 Starlet

Radioear Model 72
Mfr., E. A. Myers & Sons, Inc.
306 Beverly Rd.
Mount Lebanon
Pittsburgh 16
Distr., Radioear Corporation

Rochester Model R-1

Rochester Model R-2
Mfr., Rochester Acoustical Laboratories, Inc.
117 Fourth St., S. W.
Rochester, Minn.

Silvertone Model J-92

Silvertone Model P-15
Mfr., Johnston Hearing Aid Mfg. Company
708 W. 40th St.
Minneapolis 8

Distr., Sears, Roebuck and Co.
925 S. Homan Ave.
Chicago 7

Solo-Pak Model 99
Mfr., Solo-Pak Electronics Corp.
Linden St.
Reading, Mass.

Sonotone Model 900

Sonotone Models 910 & 920

Sonotone Model 925

Sonotone Model 940

Sonotone Model 966
Mfr., Sonotone Corporation
Elmsford, N. Y.

Super-Fonic Hearing Aid
Mfr., American Sound Products, Inc.
1303 S. Michigan Ave.
Chicago 5

Televox Model E
Mfr., Televox Mfg. Company
1307 Sansom St.
Philadelphia 7

Telex Model 97

Telex Model 99

Telex Model 200

Telex Model 300-B

Telex Model 400

Telex Model 500

Telex Model 952

Telex Model 1700
Mfr., Telex, Inc.
Telex Park
St. Paul 1

Tonamic Model 50
Mfr., Tonamic, Inc.
12 Russell St.
Everett 49, Mass.

Tonemaster Model Royal

Tonemaster Cameo Model
Mfr., Tonemaster, Inc.
400 S. Washington St.
Peoria 2, Ill.

Unex Midget Model 95

Unex Midget Model 110

Unex Models 200 & 230
Mfr., Nichols & Clark
Hathorne, Mass.

Vacolite Models J & J-2
Mfr., Vacolite Company
3003 N. Henderson St.
Dallas 6, Texas

Western Electric Models 65 & 66
Mfr., Audivox, Inc.—Successor to Western Electric Hearing Aid Division
123 Worcester St.
Boston 18

Zenith Miniature 75

Zenith Model Royal

Zenith Model Super-Royal
Mfr., Zenith Radio Corporation
5801 W. Dickens Ave.
Chicago 39

(All the accepted hearing devices have vacuum tubes.)

Accepted hearing aids more than five years old have been omitted from this list for brevity.

TABLE HEARING AIDS

Ambco Hearing Amplifier (Table Model)
Mfr., A. N. Brooks Company
684 S. Bonnie Brae St.
Los Angeles 5

Aurex Semi-Portable
Mfr., Aurex Corporation
1117 N. Franklin St.
Chicago 10

Precision Table Hearing Aid
Mfr., Precision Hearing Aids
5157 W. Grand Ave.
Chicago 39

Sonotone Professional Table Set Model 50
Mfr., Sonotone Corporation
Elmsford, N. Y.

Abstracts from Current Literature

Ear

CEREBROSPINAL RHINORRHEA FROM CRANIOMASTOID FISTULA. R. H. AMES, W. D. FARMER, and W. H. MILLS, A. M. A. Arch. Otolaryng. **53**:451, 1951.

Leakage of cerebrospinal fluid from the nose is by no means a rare sequel of head trauma. Such a finding is generally regarded as pathognomonic of a communication in the region of the paranasal sinuses or the cribriform plate. It has been shown, however, that in rare instances rhinorrhea may result from a communication between the subarachnoid space and the mastoid or middle ear, the fluid passing through the Eustachian tube and into the nasopharynx.

Ames, Farmer, and Mills report such a case of cerebrospinal fluid rhinorrhea resulting from a traumatic craniomastoid fistula in a child of 6 years. Preoperative identification of the site of leakage by catheterization of the Eustachian tube enabled the correct surgical approach to be made and prevented a misdirected exploration of the anterior fossa.

ALPERS, Philadelphia [A. M. A. Arch. Neurol. & Psychiat.].

MENINGOCOCCIC INFECTION OF THE EAR. R. POCH VINALS, Arch. pediat. **2**:91 (July) 1951.

Full case histories of 11 children with lesions of the ear secondary to meningococcic meningitis are given. The author believes that the various involvements of the inner ear, the middle ear, and the labyrinth are often overlooked in cases of acute meningitis. His study is more concerned with diagnostic points than with treatment.

The chain of events leading to an ear infection are (1) rhinopharyngitis or trauma; (2) septicemia; (3) meningitis, and (4) ear involvement.

Because of the acute illness of meningitis, deafness may not be noticed until later.

Frequently, also, there are organisms present other than the Meningococcus, and in each case presented there were different infectious and traumatic factors, but in all cases there were ear involvements not at first noticed.

ALLEN, San Francisco [A. M. A. AM. J. DIS. CHILD.].

PSYCHOSOMATIC ASPECTS OF MÉNIÈRE'S DISEASES. E. P. FOWLER and A. ZECKEL, J. A. M. A. **148**:1265, 1952.

Fowler and Zeckel suggest that a basic disorder of personality usually is present in patients suffering from Ménière's disease and that the first attack and many subsequent attacks are caused by vascular phenomena in the labyrinth which are brought on by emotional stimuli, so that Ménière's disease is primarily a psychosomatic disorder.

Twenty-three patients with clear-cut Ménière's disease were studied. Each patient was subjected to a battery of personality studies. The ages ranged from 24 to 60, and 13 patients were men. The majority of them were of an aggressive appearance and temperament. Most were unusually rugged. The 10 women were less uniform in type but, like the men, tended to be extroverts.

Fowler and Zeckel found a relationship between the appearance of the conjunctival circulation and changes within the otic mechanisms in cases of Ménière's disease during the intravenous injection of procaine. Procaine administered intravenously was selected for therapeutic trial in Ménière's disease because it breaks up lumping and increases the speed of circulation of small blood vessels in cats with experimentally produced sludge. Since intravenous administration of procaine, simultaneously with the disappearance of sludge, also altered or stopped the tinnitus in several cases of Ménière's disease, the authors present this as evidence for a vascular theory of the cause of the disease.

To substantiate further their contention that sludging may cause Ménière's disease, they observed the conjunctival vessels before and after experimental psychic stimulation. They found that the effect of the psychogenic factors seems to involve slowing and arrest of circulation in the small blood vessels within the labyrinth on an adrenergic pattern. Excessive lumping of

red blood cells and early blood sludge in the bulbar conjunctiva can be seen before and after attacks. They suggest that these lumps of blood, when caught in the smaller vessels of the labyrinth, are instrumental in the production of the labyrinthine hydrops which has been found to be the characteristic pathologic feature of the disease.

The authors conclude that in cases of advanced Ménière's disease a large percentage of patients will require psychotherapy, in addition to medical or surgical help. In early cases psychotherapy may reverse the course of the disease, so that there are few, if any, residuals. They also believe, since there is much similarity in the significant traits of all affected patients, that group psychotherapy should be considered, especially in clinics where individual treatment is too time-consuming and costly.

ALPERS, Philadelphia [A. M. A. ARCH. NEUROL. & PSYCHIAT.].

FACTORS ASSOCIATED WITH HELP OBTAINED FROM INDIVIDUAL HEARING AIDS. BRUCE M. SEIGENTHALER and GEORGE H. GUNN, J. Speech & Hearing Disorders **17**:338 (Sept.) 1952.

In 143 case records of hearing aid selections, about 67% of the patients have perceptive-type deafness, about 8% have conductive-type deafness, and the remainder have mixed conductive- and perceptive-type deafness. All types of audiograms considered in this study indicate that the patients received help with respect to threshold gain with hearing aids. Conductive-type deafness patients received significantly more help than those with other types of deafness.

PALMER, Wichita, Kan.

PROTRUDING EARS. SERGIO VIDAURRE, Plast. & Reconstruct. Surg. **10**:39 (July) 1952.

Vidaurre finds that prominent ears are caused by defective formation of the normal auricular folds rather than by excess cartilage. The operative technique which he follows is based upon that already described by McEvitt (1947). The desired operative line is determined by pressing the margin of the ear backward. The bend in the ear is along the line of the antihelix. The skin is then marked with blue ink, usually along the posterior crus of the antihelix or wherever it is necessary to give the desired contour. The auriculomastoid line is also marked to guide the injection of the procaine hydrochloride solution. One per cent procaine hydrochloride with a few drops of 1:1,000 epinephrine is used for the anesthetic, with the needle usually inserted under the lobe of the ear, which is the least sensitive region. The anterior surface of the ear is then infiltrated. The cartilage is cut entirely through along the marked line, and the skin on the outer surface of the ear is elevated with a dental spatula. The necessary amount of cartilage is removed from the concha with particular care, since too much or too little gives a poor result by creating an abnormal antihelix. The desired ellipse of skin is incised, and No. 2-0 plain absorbable sutures, U. S. P., anchor the incision. The intent of the operation, which is given in detail, is not only to correct the protrusion of the auricle but also to avoid abnormal folds within it. The operation is said to be easily and quickly performed. Photographs illustrate the preoperative and postoperative appearances of the ear, and drawings show the steps followed in the operation.

SELTZER, Philadelphia.

EARACHE. E. J. SMITH, Canad. M. A. J. **66**:234 (March) 1952.

Almost all possible causes of earache are discussed briefly. Smith stresses the point that severity of the earache is not a good indication of the severity of the disease and that earache may be an early symptom of serious disease of the upper respiratory tract or gastrointestinal tract.

MCGUIGAN, Evanston, Ill. [A. M. A. AM. J. DIS. CHILD.].

TOXIC EFFECTS OF STREPTOMYCIN COMPOUNDS WITH SPECIAL REFERENCE TO DEAFNESS. D. H. GARROW, Great Ormond Street J. **2**:133 (Dec.) 1951.

Study of complications of streptomycin therapy shows a marked incidence of damage to the hearing apparatus. In the author's hospital prior to January, 1950, 44 patients with tuberculous meningitis and 15 with miliary tuberculosis were given streptomycin sulfate or chloride for four months or longer. One of the surviving meningitis patients is deaf. Five patients with

tuberculous meningitis and one with tuberculous peritonitis were treated with dihydrostreptomycin sulfate. Two of the meningitis patients and the peritonitis patient became deaf.

The author points out that onset of deafness is acute and may appear without warning even after treatment has been discontinued. He feels that dihydrostreptomycin is contraindicated for prolonged treatment and that streptomycin sulfate is the drug of choice.

McGuigan, Evanston, Ill. [A. M. A. Am. J. Dis. Child.].

Osteosclerotic Syndrome and Overdosage of Vitamins A and D. G. Frontali, Schweiz. med. Wchnschr. **82**:430 (April 12) 1952.

A 4-year-old girl was treated with streptomycin for miliary tuberculosis of the lungs. In addition, she received 60,000 I. U. of vitamin A and 40,000 of vitamin D per day. She was dismissed after four months. The miliary lesion had cleared, as well as evidence of renal involvement. At home vitamin A medication was continued with a dosage of 150,000 I. U. every second day. About two months later the patient was readmitted. Widespread osteosclerosis, including the cranium, particularly the base, was found. There was a retention of nitrogen in the blood, an elevation of the blood pressure, and hypoisosthenuria. An anemia with reduction of erythropoietic activity existed and possibly some hepatic lesions. These lesions did not regress as rapidly as the osseous hypercalcification, which, on cessation of vitamin A medication, disappeared nearly entirely.

Amberg, Rochester, Minn. [A. M. A. Am. J. Dis. Child.].

Acoustic Neuroma Removed in Operation, with Intactness of Hearing and Impairment of Vestibular Function. C. Gama, Arq. neuro-psiquiat. **7**:314 (Sept.) 1949.

A white boy aged 15 was admitted to the hospital on Oct. 22, 1947, with a two-year history of frequent vomiting and headaches. He had difficulty with vision and diplopia for one month and was aware of a hearing defect on the left side. Examination showed the following significant signs: left facial paralysis of peripheral type, diminished sensation in the left fifth nerve, paresis of the left side of the palate, bilateral papilledema, more pronounced on the left side, left external rectus paralysis, and horizontal spontaneous nystagmus in either direction, more pronounced to the right. There were a tendency to veer to the left in the Romberg position and dysdiadochokinesia-dysmetria in the left upper limb. The patient's response to the caloric test was impaired on the left.

Special studies showed the initial pressure of spinal fluid to be 230 mm. of water, with a final pressure of 140 mm. after removal of 18 cc. of fluid. The fluid was clear; the Pandy reaction was positive, and the Wassermann reaction was negative. Roentgenograms of the skull showed erosion in the dorsum of the sella, with small suprasellar calcifications, and changes in the petrous process of the left temporal bone. A diagnosis of tumor of the posterior fossa, probably in the left pontocerebellar angle, was made.

Operation was performed on Oct. 28. Removal of a grayish tumor, 3 cm. in diameter, was followed by incision of a cyst containing xanthrochromic fluid. The capsule was also removed. Histologic examination showed it to be a neurinoma. The patient did well after the operation. Nine months later there was no evidence of impairment of cochlear function on the left side. On the other hand, there was absence of response to the caloric test, indicating pronounced involvement of vestibular function on the left side.

Savitsky, New York [A. M. A. Arch. Neurol. & Psychiat.].

Central Neurinoma of the Acoustic Nerve. P. Pinto Pupo, Arq. neuro-psiquiat. **8**:85 (March) 1950.

A white Brazilian merchant aged 45 was examined on Aug. 17, 1944, complaining of progressive deafness and tinnitus on the left side. After an ailment diagnosed as nephritis from which he suffered toward the end of 1941 he had to rest about a month. After that illness he never felt entirely well. For six months he had complained of tinnitus, diplopia, headache, progessive deafness on the left side, and paralysis of the left side of the face. Neurologic examination showed right-sided pyramidal-tract signs, with right hemiparesis and a right hemisensory

syndrome, involving pain, touch, and temperature sensibility, with sparing of the face; impairment of posterior-column modalities on the right side, with ataxia; left facial paralysis of peripheral type; mild diminution of hearing, especially on the left; left external rectus paralysis, and horizontal nystagmus on looking to the right. The patient died suddenly a few days after he was examined. Autopsy showed infarction of the brain stem at the level of the acoustic nerve. A tumor, however, was found in the pons; histologically it looked like a neurinoma. There were no glial elements in the tumor, and an area of softening surrounded it. The diagnosis was neurinoma arising in the intrapontine portion of the acoustic nerve. Signs of pyramidal involvement were present, even though the pyramidal tract was found intact.

SAVITSKY, New York [A. M. A. ARCH. NEUROL. & PSYCHIAT.].

TREATMENT OF MÉNIÈRE'S SYNDROME WITH HIGH-FREQUENCY SOUND WAVES. C. WIETHE, Wien. med. Wchnschr. **61**:466 (July 29) 1949.

Since direct surgical intervention on the labyrinth is extremely difficult and not always satisfactory, Wiethe used high-frequency sound waves (oscillations at over 300,000 hertzian [electric] waves per second) in the treatment of 26 patients with Ménière's syndrome. The advantage of this treatment lies in the possibility of pinpointing the otherwise inaccessible structures and of modifying the frequency of the sound wave and thereby the therapeutic effect. The desired effect is probably due to rhythmic rarefication and condensation of the molecular structure of the tissues, as well as to the production of heat.

The treatment was administered every day or on alternate days for an average of 10 doses. The follow-up observations of 2 to 12 months showed 18 patients to be completely free of attacks; 6 had occasional episodes at much greater intervals, and the condition of 2 remained unchanged. The tinnitus was lost in 9 patients, improved in 10 patients, and unchanged in 5 patients. There was subjective improvement of hearing in 10 patients, while the remaining 16 reported no change. Audiometer studies showed improvement of hearing in 6 patients and some improvement (not noticed by the patient) in one case; no change was discerned in 19 patients. The caloric and rotatory tests showed only slight changes.

MASON, New York [A. M. A. ARCH. NEUROL. & PSYCHIAT.].

SYMPATHECTOMY IN RELATION TO MÉNIÈRE'S DISEASE, NERVE DEAFNESS AND TINNITUS: A REPORT ON 110 CASES. E. R. GARNETT PASSE, Acta oto-laryng. **42**:133 (Feb.-April) 1952.

The origin of this work refers back to stellectomy done by Passe with Seymour in 1948. The same general effect is accomplished by the Smithwick operation of dorsal sympathectomy, which is still employed. Passe feels, however, that the effect of sympathectomy on disordered visceral function must be expressed in improvement instead of cure.

Results of this work were as follows: Eighty-eight patients with Ménière's disease were operated on. Ninety-three per cent of these have remained free of further attacks of major degree. In five patients the opposite ear became responsible for further attacks. During the convalescent stage there may be attacks of vertigo. In 16 patients with tinnitus relief was obtained in the same patients in whom there was relief from the tinnitus on blocking of the stellate ganglion. This gave partial relief in eight, complete relief in five, and none in three. Nine young people with early nerve deafness of idiopathic type were operated on; all showed improvement audiometrically on procaine block before operation. This same improvement was attained or exceeded by operation.

ROBERT LEWY, Chicago.

EFFECT OF SYMPATHETIC STIMULATION UPON COCHLEAR MICROPHONIC POTENTIALS. J. C. SEYMOUR and J. W. TAPPIN, Acta oto-laryng. **42**:167 (Feb.-April) 1952.

Experiments were performed in which there was electrical stimulation of the cervical sympathetic trunk. Measurements were then made of the cochlear microphonic potentials. Pure-tone stimuli were used between 1000 and 2000 cps. A reduction in the magnitude of the potential occurred. However, this was not accompanied by any change in the standard sinusoidal wave form. Seymour and Tappin believe that the decrease in potentials is due, at least in part,

to the diminution of the cochlear blood supply from vasoconstriction. The decrease of the potentials is sometimes preceded by a small increase. The various possible causes of this phenomenon are discussed.

ROBERT LEWY, Chicago.

AN INVESTIGATION ON THE DIFFERENCE LIMEN DETERMINED BY THE METHOD OF LUSCHER-ZWISLOCKI IN NORMAL HEARING AND IN VARIOUS FORMS OF DEAFNESS. LAURITZ LUN-IVERSEN, Acta oto-laryng. **42**:219 (June) 1952.

Lun-Iversen attempted to demonstrate recruitment by difference limen determinations. Eighty-one patients and 113 ears were examined. The Luscher-Zwislocki method for monaural difference limen in air conduction was used. Measurements were made at a frequency of 125 to 4000 cps at 40 db. above hearing threshold, if possible. When it could be done, the Fowler binaural recruitment test was also performed. The mean values found for the difference limens for all groups were fairly uniform. These included the values for difference limens in cases in which recruitment was present. All lay between 6.9 and 10%.

Therefore, with this method Lun-Iversen was not able to demonstrate recruitment by the difference limen determination.

ROBERT LEWY, Chicago.

UNDIAGNOSED OTITIS MEDIA. G. A. HOOGLAND, Nederl. tijdschr. verlosk. en gynaec. **95**:3477 (Nov. 24) 1951.

Eleven cases of acute otitis media are described which occurred in the course of infectious diseases which had not been diagnosed before admission to the hospital. In young children, otitis media frequently takes an atypical course. Only inspection of the tympanic membrane makes it possible to make an exact diagnosis and to administer adequate therapy.

VAN CREVELD, Amsterdam, Netherlands [A. M. A. AM. J. DIS. CHILD.].

Pharynx

CLOSED FOSSA TONSILLECTOMY: A METHOD FOR REDUCING POSTOPERATIVE BLEEDING. E. B. EMERSON JR., J. A. M. A. **149**:348 (May 24) 1952.

Emerson discusses a method consisting of grasping the tonsil with a tenaculum, incising the mucous membrane at the upper pole on the anterior pillar, widening it by blunt dissection with scissors, and placing a pillar retractor, at which point the scissors is replaced by a blunt dissector. Blunt dissection is carried out through the lower pole.

Sutures are entered at the point where the tonsillar pillar joins the true floor of the fossa, and the needle is passed under the true floor and brought out as near the junction of the anterior pillar and fossa as possible and then tied. Four or five interrupted sutures will usually give a clean even closure, with no undue tension on the pillars.

The problem of tonsil tags ought to be minimal if the blunt dissection is performed carefully. Plain No. 0 absorbable surgical suture, U. S. P., is used.

GORDON, Philadelphia.

AUREOMYCIN TREATMENT OF DIPHTHERIA AND DIPHTHERIA CARRIERS. SAMUEL KARELITZ, HARRY KING, and IRA S. RUBINSTEIN, J. Pediat. **39**:544 (Nov.) 1951.

Most strains of Corynebacterium diphtheriae are susceptible to easily obtainable concentrations of penicillin. Patients with acute diphtheria are therefore given antitoxin and penicillin. Over 75% of diphtheria carriers can be cleared with penicillin. Aureomycin, in doses of 25 to 50 mg. per kilogram of body weight, also is effective against C. diphtheriae. It may be used with antitoxin in acute diphtheria and may be particularly useful against penicillin-resistant strains in the carrier state.

MACDONALD, Pittsburgh [A. M. A. AM. J. DIS. CHILD.].

PATHOGENESIS OF HYPOPHARYNGEAL DIVERTICULUM WITH SPECIAL REFERENCE TO HEREDITY. HARRY BJORK, Acta oto-laryng. **42**:202 (June) 1952.

Bjork reports the occurrence of diverticulum of the hypopharynx in three sisters and the mother of the siblings. This relationship in itself is strong evidence that hereditary factors

play an important part in this condition. The histories of these patients were analyzed, as were the x-ray studies and the postoperative course. Reasoning from these factors, Bjork believes that abnormal obstruction at the mouth of the esophagus is not a prerequisite for diverticulum formation. He states that if the posterior wall of the hypopharynx is weak, a pressure of deglutition of physiologic proportion is sufficient to cause the formation of a pouch.

ROBERT LEWY, Chicago.

Larynx

ACCIDENTAL INHALATION OF AN AUREOMYCIN CAPSULE. ERNEST B. EMERSON JR. and WILLIAM L. BRADFORD, A. M. A. Am. J. Dis. Child. **84**:344 (Sept.) 1952.

A 9-month-old white boy was given a capsule to be taken with his orange juice. The mother found that he had not swallowed the capsule; therefore, she pushed it back on the tongue with her finger. Immediately the child coughed, choked, and became cyanotic. These symptoms soon ceased, but breathing was heavy, with wheeezing. On admittance to the hospital, the temperature was 100.4 F., pulse rate 120 beats per minute, and respiration 45. Cyanosis was minimal, but there were coarse rhonchi and wheeezing over the entire chest. The percussion note was about normal. X-ray examination showed "increased bronchial markings, but no atelectasis or emphysema." Bronchoscopy done 46 hours after inhalation of the foreign body, by means of a 4-mm bronchoscope, revealed swelling of the mucous membrane at the carina and at both branches of the "Y." Secretion was excessive and highly yellow. Suction removed as much of the secretion as was possible. Recovery was uneventful.

The corollary set down by Emerson and Bradford notes the severe irritation caused by this foreign body, as evidenced by swelling of the mucosa. They consider it unwise to give capsules or tablets to small children by forcing them down the throat, since aspiration may cause asphyxia and a fatal issue, depending upon the solubility of the foreign body.

I. W. VOORHEES, New York.

IODIZED OIL ASPIRATION IN THE NEWBORN. JOHN DE CARLO JR., ARNOLD TRAMER, and HENRY H. STARTZMAN JR., A. M. A. Am. J. Dis. Child. **84**:442 (Oct.) 1952.

This study was undertaken in Baltimore City Hospital and the University of Maryland Medical School because in the picturization of the esophagus in newborn infants oil was found in the trachea and bronchial tree. The group of 100 babies were from 12 to 24 hours old. The agent used was chloriodized oil (iodochlorol®). There were no feeding problems or neonatal difficulties. The expectation that the coughing reflex would aim to reject the oil was not justified, since H. C. Miller and associates have stated that vagal function is not fully developed in the newborn, as proved by bronchoscopy in 154 infants in whom no cough reflex was present in at least 50% of those tested [Yale J. Biol. & Med. **24**:284-291 (Feb.) 1952]. When routine x-ray studies of the infant esophagus are being done, it is well to remember that an erroneous impression of a fistula between the esophagus and the tracheobronchial tract may be given when iodized oil is used.

In conclusion, 13% of newborn infants studied here aspirated iodized oil during the first 24-hour period. This aspiration probably results from neuromuscular immaturity and from the low surface tension of this oil.

Abstractor's Comment: One might expect that something would be said of the possibility of pneumonia from the presence of oil in the lungs, since this has been reported in the literature, but no note was made of any such untoward happening.

I. W. VOORHEES, New York.

ESOPHAGOSCOPY IN ESOPHAGOGASTROINTESTINAL HEMORRHAGE. G DESFORGES, F. H. AVES, and J. W. STRIEDER, J. A. M. A. **149**:639 (June 14) 1952.

This article will interest those otolaryngologists who perform extensive esophagoscopies. The authors are thoracic surgeons. Their information is culled from clinical material obtained in their experiences from July 1, 1950, to June 1, 1951. The article is a short one and is accompanied by a table and an analysis of their cases.

Those interested should consult the original article.

GORDON, Philadelphia.

SPEECH REHABILITATION AFTER TOTAL REMOVAL OF LARYNX. N. M. LEVIN, J. A. M. A. **149**:1281 (Aug. 2) 1952.

Levin discusses in moderate detail the problems that confront the patient who has undergone total laryngectomy. This article is illumined with figures and fuller discussions on the altered anatomy and physiology after operation, the surgical anatomy and technique, the mechanism of esophageal speech, methods of instruction and training, artificial larynx and other mechanical devices, emotional and psychological considerations, and rehabilitation.

The reader is urged to consult the original article for the necessary details, for this type of article cannot be abstracted without loss of the complete message that the author intended.

GORDON, Philadelphia.

Nose

CORRECTION OF THE WIDE NOSE WITH A PINCH SUTURE. MARIO GONZÁLEZ-ULLOA, Plast. & Reconstruct. Surg. **10**:31 (July) 1952.

González-Ulloa reports on his operation of choice for correction of the wide nasal base. He has found the method particularly useful after a previous rhinoplasty which has left the base of the nose too wide. The method has not proved suitable when excess width is present together with markedly convex alae or when the nose is flat, since cartilage support is needed. The incision is made in the gingivolabial sulcus and is undermined to the base of the alae. A curved needle with No. 34 stainless-steel wire is passed through the base of the alae from one side to the other. The wire is then tied, with the loop drawn to a size to secure the desired width of the base of the nose. It is desirable to overcorrect slightly to allow for later relaxation of tissue. The wire is carefully knotted and twisted on itself to prevent slipping before it is cut close. Compression is provided by the application of adhesive tape on the outer surface of the lip. After two years of use no contraindications of the method have been experienced.

SELTZER, Philadelphia.

SADDLE NOSES. SERGIO VIDAURRE, Plast. & Reconstruct. Surg. **10**:35 (July) 1952.

Vidaurre reviews the various types of graft material that have been used in the past for reconstruction of saddle nose. A method which he prefers is then described. Semilunar cartilages of the knee are procured from the orthopedic clinic and fixed for one month or more in 1% thimerosal (merthiolate®). When ready for use, a cartilage of the desired size is washed in saline solution and is incised along the base of the triangular piece of tissue to provide the cleft that is to fit over the saddled septal dorsum. An incision is made either through the columella or along a line between the eyebrows through which the graft is inserted. The advantages claimed for the method are that the material is easily obtained, it requires little modeling, it is surrounded by peritoneum, and the graft remains vital and apparently becomes permanently engrafted. In the relatively few cases reported good results have been obtained. Photographs and drawings illustrate the method and the results.

SELTZER, Philadelphia.

RELIEF OF VESTIBULAR NASAL OBSTRUCTION BY PARTIAL RESECTION OF THE NASAL PROCESS OF THE SUPERIOR MAXILLA. BEVERLY DOUGLAS, Plast. & Reconstruct. Surg. **10**:42 (July) 1952.

Douglas considers three types of nasal obstruction but describes only the type that is either of congenital origin or caused by fracture of the nasal or the facial bones, which results in some degree of closure of one nostril. This effect may be brought about by a displacement of the septum or of the maxilla, either singly or in combination. A submucous resection is recommended for any deviation of the septum. Technique is given for partial submucous resection of the nasal process of the superior maxilla. The field is anesthesized, and through a curved or an S-shaped incision a wedge-shaped section of the free edge of the bone is removed from under the periosteum, by means of a chisel or a rongeur. This procedure is done without entering the antrum. The cut surface of the bone is smoothed off with a Joseph nasal rasp, and closure of the mucoperiosteum follows, without drainage. Stitches are removed after seven days, and

the nostril is kept open by means of a large soft rubber catheter passed every day. Postoperative swelling may produce some temporary obstruction. External deformity following this procedure has not been observed. Eight patients have been given this type of treatment, with satisfactory results.

SELTZER, Philadelphia.

BILATERAL ANOSMIA AS AN EARLY AND SOLE MANIFESTATION OF OLFACTORY-GROOVE MENINGIOMA. L. BARRAQUER-BERRÉ and J. ARUMI FARGAS, Rev. españ. oto-neuro-oftal. **52**:5 (Nov.-Dec.) 1950.

Barraquer-Ferré and Arumi Fargas report the case of a woman aged 45 with a verified olfactory-groove meningioma in whom bilateral anosmia was known to exist as the only symptom for three years. Visual symptoms developed in the fourth year of her disease.

ALPERS, Philadelphia [A. M. A. ARCH. NEUROL. & PSYCHIAT.].

NEUROLOGIC COMPLICATIONS OF OSTEOMA OF THE PARANASAL SINUSES: EXTRADURAL PNEUMATOCELE DUE TO OSTEOMA OF THE FRONTAL SINUS; REPORT OF A CASE. R. MELARGNO FILHO and MOYSES CUTIN, Arq. neuro-psiquiat. **9**:133 (June) 1951.

A white man aged 38 entered the hospital, with frontal headaches and weakness of the right side of the body of one month's duration. Examination showed mild hemiparesis and deep hyperreflexia on the right side, but no pathologic reflexes; there was no choking of the disk, and examination of the spinal fluid showed a normal status. X-ray examinaton of the skull revealed a mass in the medial portion of the left frontal sinus and a large collection of gas, evidently extradural, over most of the left cerebral hemisphere. Tomographic studies confirmed the presence of an osteoma and erosion of the posterior wall of the left frontal sinus. An electroencephalogram showed an asymmetrical record, with waves of greater amplitude on the left side. A tumor of the left frontal sinus was removed at operation; the dura was intact. Histologic study of the tumor showed it to be an osteoma, somewhat eburnated. The hemiparesis was due to pressure of the extradural pneumatocele on the brain. Formation of the pneumatocele in this case was possible because the passage between the frontal sinus and the nose was not occluded by tumor.

SAVITSKY, New York [A. M. A. ARCH. NEUROL. & PSYCHIAT.].

Miscellaneous

THE PROBLEM OF RECURRENT HEADACHE. GEORGE A. WOLF JR., New York J. Med. **52**:2361 (Oct.) 1952.

Careful taking of a history may help in the delineation of the problem. The patient may be frightened and have in mind some dire disease when in fact the difficulty is definitely psychosomatic, but organic lesions are thoroughly possible. The condition of one patient regarded as "frightened" always improved immediately after the ingestion of one acetylsalicylic acid tablet. Eventually adenoma of the pituitary gland was found! Pain-sensitive structures are the following: the large arteries at the base of the brain, branches of the external carotid, small tributaries of the venous sinuses, certain cranial nerves, and skeletal muscles of the scalp. Vascular headaches were relieved by the administration of the vasoconstrictor drugs. As for the nasal sinus headaches, engorgement of the ostia and pressure points therefrom caused dull, aching, and poorly localized pain. These symptoms were dramatically relieved by cocainization of the ostia (Sluder). Further studies call for x-ray examination of the sinuses and refraction of the eyes with, of course, study of the fundi, with lumbar puncture and electroencephalography, if necessary. Wolf stresses management far more than treatment. Much depends on getting the patient's psychological state to run smoothly, avoiding time-wasting and energy-consuming unimportant matters in business or social life. Drugs, especially narcotics, are to be used cautiously. Tepid tub baths for 25 to 30 minutes each day or intensive hydrotherapy for periods of six weeks sometimes produce good results.

Abstractor's Comment: Wolf seems to think that very often a wise physician can talk the patient out of his head pains. But what about those severe "migraine" headaches, when a breath of air blowing across a cheek will set up a terrific paroxysm? Moreover, what about alcohol injections? Are they out in these modern days?

I. W. VOORHEES, New York.

News and Comment

WANTED—EAR, NOSE, AND THROAT JOURNALS FOR KOREA

An urgent request has come from the head of the department of otolaryngology of Severance Union Medical College in Seoul, Korea, for back files of journals in this field, especially mentioning the ARCHIVES OF OTOLARYNGOLOGY. All back numbers, from 1941 to the present, whether the files are complete or not, would be greatly appreciated.

The Severance Medical College lost its entire library during the first months of the war. The school is being gradually rehabilitated, and one of their greatest needs is the restocking of the library. Those interested in contributing copies of this journal are requested to communicate with Dr. Douglas N. Forman, Christian Medical Council for Overseas Work, Room 1111, 156 Fifth Ave., New York 10.

Books

Penicillin in Severe Otorhinolaryngological Complications: A Symposium. By Danish-Norwegian-Swedish Otolaryngological Joint Research. Price, $2.50. Pp. 120. Ejnar Munksgaards Forlag, Nørregade 6, Copenhagen K., 1951.

This recent symposium is the result of numerous investigations of the treatment of such otolaryngological complications as meningitis, tympanogenic labyrinthitis, cerebral abscess, petrositis, and sepsis by Danish, Norwegian, and Swedish workers, headed by Robert Lund. This work was completed in 1950. The table of contents includes the following: 1. Bacteriological Problems, Resistance Test, Blood-Cerebro-Spinal Fluid, Barrier; 2. Penicillin Treatment of Meningitis; 3. Tympanogenic Labyrinthitis; 4. Rhinogenic Osteomyelitis; 5. Thrombophlebitis; 6. Allergy and Incidental Toxic Effects.

Each of the co-workers of this joint enterprise has not only analyzed the statistics of the cases reported but has reviewed the literature concerning his particular subject. Such a review and study is worth-while reading for all otolaryngologists.

Diseases of the Nose, Throat and Ear: Handbook for Students and Practitioners. By I. Simson Hall, M.B., Ch.B., F.R.C.P.E., F.R.C.S.E., Surgeon to the Royal Infirmary, Edinburgh. Fifth edition. Price, $4.00. Pp. 463, with eight colored plates and 82 illustrations. Williams & Wilkins Company, Mount Royal and Guilford Avenues, Baltimore 2, 1952.

This compact little book maintains the size and purpose for which its original volume was designed. The author presents those aspects of the field which would be of particular interest to the student and general practitioner. However, it has some merit even for the specialist because of the viewpoints which the author presents. In this edition, changes in treatment which have been accepted are introduced where appropriate, but controversial matters are avoided. The contents are presented as follows: Section I—The Nose; Section II—Nasal Accessory Sinuses; Section III—The Pharynx; Section IV—The Larynx; Section V—Endoscopy; Section VI—The Ear. Each section begins with a short anatomical description, and then the author discusses the various clinical entities which are appropriate for discussion. The Appendix and Formulae seem somewhat at odds with the usual methods employed by most large centers here.

The subject matter is presented in a direct manner. The printing is good, and the illustrations are clear. As a handbook, it is recommended.

Topographischen Ausdeutung der Bronchien im Röntgenbild. By Dr. Claus Esser. Price, $8.00 (33 German marks). Pp. 152, with 77 illustrations, Georg Thieme, Diemershaldenstrasse 47, 14a Stuttgart-O, Germany.

This book represents a careful and detailed study of bronchial anatomy as it is manifested roentgenographically. The techniques of conventional film study of the lungs, body section study, and principally bronchography are used to evaluate the anatomical features of the bronchi.

Following a review of previous studies of bronchial anatomy and of the various systems of nomenclature, there is a general evaluation of the form and characteristics of the bronchi.

The remainder of the book, 110 pages, is devoted to a well-presented discussion of the roentgenographic anatomy of the bronchi. The origin, variations, course, characteristics, vascular relations, x-ray demonstration, and nomenclatures of each segmental division are discussed and illustrated. The figures throughout are of high quality and excellently supplement the text.

While there is little in this text that is new, it does represent a thorough and accurate presentation of its subject. It will be useful to those who find a precise knowledge of bronchial anatomy valuable.

The Pathology, Symptomatology and Diagnosis of Certain Common Disorders of the Vestibular System. By M. R. Dix and C. S. Hallpike. Proc. Roy. Soc. Med. **45**:341-354 (June) 1952.

This 14-page finely printed monograph is a most clear, comprehensive, and thoughtful study of the clinical and pathological aspects of true and false Ménière's disease. The article is introduced by a historical review of papers and studies from the time Ménière's first description appeared. It is now evident that, though Ménière established a distinct entity in his triad of deafness, dizziness, and tinnitus, associating it with vestibular pathology, since that time "this field has become much enlarged and its contours very confused. It has been customary to mix together with Ménière's disease. . . other types of organic vertigo which conform only vaguely to the established symptomatology and pathology of that disease."

The authors present ably and clearly the position of quantitative galvanic testing in the differential diagnosis of true and false types. They describe two common causes of organic vertigo, one a disorder of the vestibular neurons, another a disorder of the otolith system in the labyrinth. Both are liable to be confused with Ménière's disease and often carry the familiar label.

It is noted that "the phenomenon of adaptation is abnormally rapid in cases of Ménière's disease" (a very true observation missed by many clinicians). The authors note also a diagnostic point in the great loss of speech intelligibility which is out of proportion to the pure-tone audiometric thresholds.

The reasons for the selections in many cases of a preferable diagnosis of vestibular neuronitis are convincingly given.

The techniques of determining an otolithic pathologic condition are carefully covered in a lengthy dissertation on positional nystagmus.

The article must be carefully read to be appreciated and does not lend itself to a short review. It marks a milestone in the literature on the subject.

The 1951 Year Book of the Eye, Ear, Nose, and Throat. Edited by Derrick Vail, M.D., D.Oph. (Oxon.), F.A.C.S., Professor and Director, Department of Ophthalmology, Northwestern University Medical School; and John R. Lindsay, M.D., Professor of Otolaryngology, University of Chicago, The School of Medicine. Price, $5.50. Pp. 456, with 133 illustrations. The Year Book Publishers, Inc., 200 E. Illinois St., Chicago 11, 1952.

This current volume attempts to include all the significant advances and developments which have occurred during the past year that are important in the daily practice of treatment of diseases of the eye, ear, nose, and throat. Both editors have been successful in organizing and presenting in a concise way a complete coverage of the particular field among the topics they discuss. Included are discussions of limited hearing effects on speech development, ears in industry, otosclerosis and fenestration, and newer drug and antibiotic therapy.

It is a handbook all specialists and many general practitioners will find worth while having in their libraries, for it is an excellent source of reference and review.

Oral and Dental Diseases. By Hubert H. Stones, M.D., M.D.S., F.D.S.R.C.S., Professor of Dental Surgery and Director of Dental Education, University of Liverpool; General Consultant and Director, Liverpool Dental Hospital; Consultant, Maxillo-Facial Centre, Broad Green Hospital, Liverpool; Editor in Chief, International Dental Journal. Second edition. Price, $17.50. Pp. 1012, with 959 illustrations, 91 in color. Williams & Wilkins Company, Mount Royal and Guilford Aves., Baltimore 2, 1951.

This book is essentially a textbook for dental students and a reference book for dental and medical practitioners. It attempts to cover all aspects of etiology, histopathology, clinical features, and treatment of oral and dental diseases. In this second edition, the author has revised much of the material and brought the subject matter up to date. This revision is noted particularly in the discussions of dental caries, stomatitis, and allied diseases of the oral mucosa. Included in the new material is a section on diseases of the nervous system. The colored illustrations are worthy of special attention for clarity of reproduction. The paper and printing are also good. For the purposes for which this book has been presented, it is recommended. It should be included in the library of dental students, hospitals, and practitioners treating diseases of the teeth and jaws because of its encyclopedic character.

Clinical Radiology of the Ear, Nose and Throat. By Eric Samuel, M.D., F.R.C.S., F.F.R., D.M.R.E., late Hon. Radiologist, The Middlesex Hospital, London; Late Radiologist, Royal National Ear, Nose and Throat Hospital, London. Price, 70s. net. Pp. viii + 339, with 320 illustrations. H. K. Lewis & Co., Ltd., 136 Gower St., London, W.C. 1, 1952.

An attempt has ben made to present a text of interest to the radiologist, student, and otorhinolaryngologist. This has been done in this book, which is recommended. However, some exceptions might be taken to some of the viewpoints of the author. It is also unforunate that positive reproductions have been used throughout the book, since there is some loss of contrast and detail. Both the text and the illustrations supplement one another and reveal painstaking effort of the author and the assistance that he has received from various workers.

The contents are presented in the following sequence: Section I. The Nose and Paranasal Sinuses; Section II. The Auditory Apparatus; Section III. The Larynx and Pharynx. Each portion takes up radiological examination, followed by development and radiological anatomy, inflammatory and allergic states, tumors and new growths, traumatic lesions, and finally post-operative changes.

This book from Great Britain should be read by those for whom it is intended, namely, radiologists and otolaryngologists.

Progress in Ophthalmology and Otolaryngology: A Quadrennial Review. Volume I. Edited by Meyer Wiener, M.D.; A. Edward Maumenee, M.D.; Percy E. Ireland, M.D., and Joseph A. Sullivan, M.B. Price, $15.00. Pp. 666. Grune & Stratton, Inc., 381 Fourth Avenue, New York 16, 1952.

Part I of this textbook, in brief review, concerns itself with progress in ophthalmology and discusses the various aspects of the field in four large sections as follows: (1) basic science in ophthalmology; (2) diagnosis and treatment of diseases of the eye; (3) surgery of the eye; (4) related subjects. Part II discusses progress in otolaryngology as related to (1) the ear, (2) the nose, sinuses, and nasopharynx, (3) the larynx, tracheobronchial tree, and esophagus, and (4) allergies.

This volume is dedicated to the beginner in the specialty and to the busy practitioner. The editors-in-chief have selected contributors who write authoritatively on the subject they have on hand. However, because of the many different viewpoints that are presented it is surprising that there are not more differences of opinion than this book presents, since some chapters tend to overlap one another. This also makes for a certain unevenness of presentation which might well be avoided in future editions, at which time it is hoped that the printing and proofreading might be somewhat improved, also. The response to this book should perhaps be favorable, for it seems to fulfill the purposes for which it was designed, though it seems to be but little more than an elaboration of some other similar works.

Directory of Otolaryngological Societies *

INTERNATIONAL

Canadian Otolaryngological Society
(Société Canadienne d'Otolaryngologie)

President: Dr. D. E. S. Wishart, 170 St. George St., Toronto.
Secretary: Dr. W. Ross Wright, 361 Regent St., Fredericton, N. B.
Place: Minaki Lodge, Minaki, Ont. Time: June 14-18, 1953.

Fifth International Congress of Oto-Rhino-Laryngo-Broncho-Esophagology

Place: Amsterdam. Netherlands. Time: June 8-13, 1953.
President: Prof. Dr. Eelco Huizinga.
General Secretary: W. H. Struben, Viottastraat 1, Amsterdam-Z
Scientific Secretaries: Dr. J. Bijtel and Dr. P. G. Gerlings.

International Congress of Audiology

Place: Leyden, Netherlands. Time: June 5-6, 1953.
General Secretary: Dr. H. C. Huizing, 182 Oostersingel, Groningen, Holland.

International Course in Paedo-Audiology

Place: Groningen, Netherlands. Time: June 1-4, 1953.
General Secretary: Dr. H. C. Huizing, 182 Oostersingel, Groningen, Holland.

Pan American Association of Oto-Rhino-Laryngology and Broncho-Esophagology

Meeting: Fourth Pan-American Congress of Oto-Rhino-Laryngology and Broncho-Esophagology.
Place: México, D. F., Mexico. Time: January, 1954.
President: Dr. Justo Alonso.
Exec. Secretary: Dr. Chevalier Jackson, 1901 Walnut St., Philadelphia 3, Pa.
President of Congress: Dr. Ricardo Tapia Acuna.

Third Latin-American Congress of Otorhinolaryngology and Bronchoesophagology

Place: Caracas, Venezuela. Time: 1953.

NATIONAL

American Medical Association, Scientific Assembly, Section on Laryngology, Otology and Rhinology

Chairman: Dr. Dean Lierle, Iowa City.
Secretary: Dr. Sam H. Sanders, 1089 Madison Ave., Memphis 3.
Place: San Francisco.

American Academy of Ophthalmology and Otolaryngology

President: Dr. James Milton Robb, 315 Lakeland Ave., Grosse Pointe 30, Mich.
Executive Secretary-Treasurer: Dr. William L. Benedict, 100-1st Ave. Bldg., Rochester, Minn.
Place: Palmer House, Chicago. Time: Oct. 11-17, 1952.

American Board of Otolaryngology

Secretary: Dr. Dean M. Lierle, University Hospitals, Iowa City.
Place: Roosevelt Hotel, New Orleans. Time: April 21-25, 1953.

* Secretaries of societies are requested to furnish the information necessary to keep this list up to date.

American Broncho-Esophagological Association

President: Dr. Fred W. Dixon, 1027 Rose Bldg., Cleveland.
Secretary: Dr. Edwin N. Broyles, 1100 N. Charles St., Baltimore 1.
Place: Roosevelt Hotel, New Orleans. Time: April 28-29, 1953.

American Laryngological Association

President: Dr. Louis H. Clerf, 128 S. 10th St., Philadelphia 7.
Secretary: Dr. Harry P. Schenck, 326 S. 19th St., Philadelphia 3.
Place: Roosevelt Hotel, New Orleans. Time: April 26-27, 1953.

American Laryngological, Rhinological and Otological Society, Inc.

President: Dr. Francis E. LeJeune, 49 Audubon Blvd., New Orleans 18.
Secretary: Dr. C. Stewart Nash, 708 Medical Arts Bldg., Rochester 7, N. Y.
Place: Roosevelt Hotel, New Orleans. Time: April 28-30, 1953.

SECTIONS:

Eastern.—Chairman Dr. Irl H. Blaisdell, 1100 E. Genesee St., Syracuse 10, N. Y.
Place: Hotel Syracuse, Syracuse, N. Y. Time: Jan. 7, 1953.
Southern.—Chairman: Dr. W. W. Wilkerson, Jr., Curtiswood Lane, Nashville 4, Tenn.
Place: Andrew Jackson Hotel, Nashville, Tenn. Time: Jan. 12, 1953.
Middle.—Chairman: Dr. Henry L. Williams, 818 4th St., S. W., Rochester, Minn.
Place: The Drake, Chicago. Time: Jan. 19, 1953.
Western.—Chairman: Dr. Alden H. Miller, 4000 Woking Way, Los Angeles 27.
Place: The Elks Club, Los Angeles. Time: Jan. 24, 1953.

American Otological Society, Inc.

President: Dr. Albert C. Furstenberg, 201 S. Main St., Ann Arbor, Mich.
Secretary-Treasurer: Dr. John R. Lindsay, 950 E. 59th St., Chicago.
Place: Roosevelt Hotel, New Orleans. Time: May 1-2, 1953.

American Otorhinologic Society for the Advancement of Plastic and Reconstructive Surgery, Inc.

President: Dr. Benjamin H. Shuster, 1824 Pine St., Philadelphia.
Secretary: Dr. Louis Joel Feit, 50 Park Ave., New York 16.

American Society of Ophthalmologic and Otolaryngologic Allergy

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